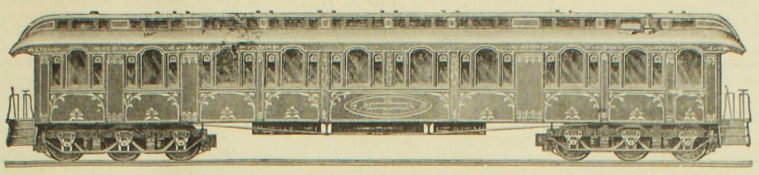
NATIONAL CAR AND LOCOMOTIVE BUILDER.



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Miscellaneous Items.

The Chicago, Alton & St. Louis Railroad has three engines running with side rods of 1 section, which were forged in that shape under the hammer.

Mr. George M. Pullman and other capitalists are said to be engaged in forming a company that has for its object the erection of works at Pullman, Ill., for the building of locomotives. It is said that Mr. W. H. Fenner will be the leading spirit in pushing this new enterprise.

The New York Central & Hudson River Railroad Company are about to equip 500 of their freight and stock cars with automatic air brakes, the intention being to run such cars on fast trains that will make passenger train time. Mr. Buchanan has designed a locomotive specially for this service.

The Schenectady Locomotive Works are putting the Richardson balance valve on a great many engines. In connection with it, they apply to the steam chest a combined pressure and release valve which acts as a safety valve in case of over pressure and supplies air when a vacuum is created in the steam chest.

During the month of August the Western & Atlantic had 48 locomotives in service, each of which made over 3,000 miles of running at a total average cost of 12.11 cents per mile. The details of this expense are repairs, 1.64c.; fuel, 4.59c.; oil tallow and waste, 0.46c.; engineers, firemen and wipers' wages, 5.31c.; material, 0.11c.

We are informed by Mr. I. W. Baldwin, general superintendent of the Central Vermont Railroad, that his company are experimenting with steam as a means of heating their cars. They have fitted up a train with the Safety Car Heating and Lighting Company's apparatus, and if the experiment proves successful they will fit out all their trains with the same system.

The Chicago & Northwestern Railway Company are building a laboratory in connection with their shops at West Chicago and a house for an electric plant that will be used for lighting the shops. The incandescent system of lighting has been adopted, and it is the intention to run in each shop lights sufficient to enable work to be carried on for ten hours when the day is shortest.

Mrs. Susan L. Sinclair, of Allegheny, Pa., has obtained a patent on an improved form of chilled car wheel. The claims made for the invention are, a chilled tread having one or more transverse grooves or recesses filled and closed with metal cast therein, the same to conform to the contour of the wheel thread and the wheel is designed with a double walled web in combination with the features mentioned.

The locomotives which pulled President Cleveland's train over the Chicago, Alton & St. Louis Railroad were equipped with the Wilson spark arrester. One engine took the train from St. Louis to Bloomington and the other from Bloomington to Chicago, the entire run having been made at night. The conductor got special orders to watch if any sparks were thrown, and he reported that he did not see a single spark during the whole journey, and that the run was the cleanest he ever saw made.

In connection with his compound locomotives, Mr. F. W. Webb, locomotive superintendent of the London & Northwestern Railway, expects, in the near future, to be able to run through fast passenger trains without the engine having any tender. As the engines are said to do a given quantity of work with very little water, Mr. Webb intends to place a small tank on the frames of the engine, and replenish it frequently by lifting water from troughs placed in the middle of the track. As the engines on this road do not slacken speed, like the Pennsylvania engines, when they are picking up water, it is not expected that any delay or inconvenience will result from the adoption of Mr. Webb's plan.

The Ensign Car and Car-wheel Manufacturing Co., at Huntington, W. Va., have commenced the erection of an additional building 100 × 108 feet, which will be used as an erecting shop, the present one, owing to the rapid growth of business, not being sufficiently large. At present 11 cars are turned out complete every day, but orders are coming in so rapidly that it is necessary to increase the capacity of the works. The orders they have at present on hand will keep the concern running at its fullest capacity for a year to come.

In the car shops of the Chicago & Northwestern Railway at West Chicago they are finishing six new milk cars, to meet the growing demands of that business. They made some experiments lately on the economy or otherwise of grinding wheels that had been slid flat. They have decided that it pays very well, and the superior working of the wheels after they are ground is very noticeable. Mr. Schroyer speaks very favorably of the work done by a Niles lathe for turning tires which grasps the axle. They turn three pairs of car wheels in it in ten hours. They have adopted the practice of gauging wheels by the center of the axle when putting them on, and find it much better than the old way.

The Michigan Central Railroad Company are building 10 passenger cars at their Detroit shops for their fast train service, and which possess several features new to day-coaches. These cars have a toilet room in each end, and, in addition, a smoking room, with passages at the side, as in sleeping cars, at the gentlemen's end. The toilet rooms have solid slate floors, and the smoking room, 6 feet 2 inches by 6 feet 10 inches in the clear inside, is arranged, upholstered and lighted in the same style as a Pullman. The windows are 2 feet 11 inches between centres, the interior finish is in marble and oak, and the seats are upholstered in red plush with flexible corners. Mr. E. D. Brown is general foreman in charge of these shops.

Mr. George D. Brooke has been appointed master mechanic of the Eastern Division of the Texas Pacific Railway, with headquarters at Marshall, where he will have charge of the principal machine shops on the system. Mr. C. H. Mead, general foreman of the Car Department of the Texas Pacific Railway, has been made master car-builder for the road. Both the above appointments have been made by Mr. Jacob Johann, superintendent of motive power power and rolling stock of the Texas Pacific Railway. Both of the officers which he has placed in the responsible positions named were foremen with Mr. Johann on the Chicago & Atlantic Railway at Huntington, Ind. Both are excellent mechanics and highly intelligent men—the class of well educated mechanics coming to the front in railroad service to the benefit of all concerned. The Texas Pacific Railroad are fortunate in securing such able mechanical officers.

Mogul locomotives are used entirely by the Delaware & Hudson Canal Company for freight service. The engines are worked very hard on a road that has many curves and grades. Knowing the objection raised by the master mechanics of many roads to Mogul engines on account of their tendency to cut the flanges of the pony truck wheels we expected to find traces of this source of expense in the Delaware & Hudson Canal moguls, but on examining several of them we found there was no appearance of flange cutting or of the tendency to run to one side. On questioning Mr. Blackall, superintenent of motive power, as to how he met with immunity from what appeared to be a universal evil, he explained that his remedy was very simple and consisted in merely turning the tire of the pony truck wheels with a little cone than is usually given to tires. Of course the truck has to be proportioned properly.

Mr. A. J. Stevens, general master mechanic of the Central Pacific Railway system, is on a visit to the Eastern States, and we recently enjoyed a pleasant chat with him respecting railroad mechanical matters on the Pacific slope. The business of the railroads is so active that the Central Pacific system is badly in need of one hundred more locomotives, and the company would order them if it were possible to get immediate delivery. As it is, the orders have to stand away back, and the company are doing all in their power to build engines fast enough to help over the existing urgent demand for power. They have at present thirteen new engines on the floor. The passenger engines will have cylinders 18 × 28 inches, and the freight engines are of the El Gobernador type, with cylinders 19 × 30 inches, four pairs of drivers coupled, a four-wheel truck and the Stevens valve gear. This gear is giving the highest satisfaction as a means of saving steam and of increasing the capacity of the cylinder.

The monotony of the account, stating how robbers stopped a train on a Southwestern railroad and took whatever they wanted without opposition or molestation, has met with a slight variation in a case which happened near El Paso, Texas, last month. The knights of the revolver stopped a passenger train in the stereotyped fashion, and broke open the door of the express car by exploding a dynamite bomb. When the thieves proceeded to enter the car thus laid bare for their operations, the express messenger instead of holding up his hands and besecching the robbers to spare his life for the sake of his wife and innocent children, seized a gun and shot two of the assailants of the property he had in charge. The remainder of the gang fled, and robbing the train proved a signal faiure. The citizens of Texas admire a plucky action like that displayed by the express messenger. When he returned to El Paso the people gave him an ovation, presented him with $100 and a fine suit of clothes, and the company whose property he had saved sent a telegram congratulating him on his bravery.

In the car shops of the Chicago, Rock Island & Pacific Railway, at Chicago, Mr. Verbryck is working mostly on rolling stock for the Chicago, Kansas & Nebraska extension. There are three new combined baggage, mail and express cars well advanced towards completion, and they have just finished a business and pay car. The greater portion of the passenger equipment of this road is provided with the Baker heater, which the officers consider fairly safe in case of accidents, and they are not making any changes at present, although an interested look out is kept on all improvements in car heating. The company will feel pretty well assured as to what is the most promising improved method of car heating, before they decide to make any change. In the locomotive shops Mr. Twombly has five of his eight wheel standard locomotives for the Kansas extension well advanced. The engines have cylinders 18 × 24 inches, driving wheels 62 inch centers, a straight boiler 56 inches diameter at smallest ring and 182 flues 2 inches diameter. The engines have diamond stacks. They are getting out the material for 6 new pony engines for switching. A hydraulic riveting plant has been purchased from Bement, Miles & Co., Philadelphia, and they are making additions to the boiler shop to hold the apparatus.

"We recently had the pleasure," says the *American Machinist*, "of a call from A. G. Brown, of Glasgow, Scotland. Some two years ago Mr. Brown went to Glasgow in the interest of the Westinghouse engine, and his present brief visit to this country is a business one. Mr. Brown, who is a mechanic and engineer of recognized ability, and a close and accurate observer, while pleased with many things in Glasgow, has lost none of his interest for things in this country. His experience is that, if mechanics lived as well there as they do here, it would cost them quite as much. He also thinks that, notwithstanding they work for very materially less wages, general machine work costs quite as much there as here. There is not, he says, that interest in getting along with work—getting the job done—which characterizes American mechanics. His observations confirm the opinion we have often expressed, that in large tools and conveniences for handling heavy work they are far ahead of us, but in small tools and in means for doing light work we are quite as far ahead. The means provided by the railroads for suburban travel Mr. Brown considers far superior to those provided in this country. Suburban trains make quick time, and the rates are much lower than they are here, notwithstanding the fact that through rates are higher. Yearly tickets are issued, upon which the holder may ride as much as he chooses, if it is all the time. The Westinghouse Company are establishing works at Glasgow for manufacturing engines, and Mr. Brown returns with the expectation of being absent five years."

Engineering and Shop Notes.

IN BUFFALO.

The district where most of the railroad shops are located in Buffalo would not strike the searcher after beautiful scenery or artistic surroundings as ideal Elysian fields, but it has the utilitarian merit of having the shops which a man interested in railway machinery wishes to visit grouped within a very convenient area. Having only one day to devote to sight-seeing in Buffalo, I was anxious to make the most of it, and I consulted Mr. W. E. Corcoran, the railroad authority for the *Evening News*, and he supplied me with a pocket map with no less than ten shops marked within easy visiting distance. Any of our railroad friends visiting Buffalo and desiring to see as much as possible of the shops there can not do better than consult with Mr. Corcoran, and they will find that he knows more about railroad mechanical news than any other man in Buffalo.

WAGNER PALACE CAR WORKS.

The first place I visited was the Wagner Palace Car Works, where I found that Mr. T. A. Bissell, the general superintendent, had so many interesting things to show that instead of part of one day, a couple of days might have been spent very profitably in the works. The shops are very extensive and promise in the near future to equal in magnitude any thing of the kind in the country. They are very well arranged for handling work promptly and economically, the extensive experience of Mr. Bissell and his intimate acquaintance with the merits and short, comings of all existing shops of any note having guided the Wagner Palace Car Company free from many expensive pit falls which others who built with fewer lights of experience fell into. As we intend illustrating these shops, it is unnecessary now to enter into details as to the extent or arrangement of the buildings.

Besides getting out the work for 45 of their ordinary stock of handsome sleeping cars run by the company, the shops are building two magnificent private cars—one for Mr. Vanderbilt, the other for Dr. Webb—and they are also engaged on sundry orders for passenger equipment. The private cars promise to eclipse any thing of the kind now on wheels. The cars are 68 feet long over sills, 9 feet 8 inches wide, and the height is 10 feet 1½ inches from bottom of sills to top of roof. The staterooms are finished in mahogany, the observation room is finished in English oak and the kitchen in walnut. All the fittings and furnishings are rich and elaborate.

While I was in the shops they were fitting up some of their sleeping cars with vestibules to make a continuous train. Mr. Bissell had tried several forms of covering for the vestibule, and he appeared to have settled upon folds of strong canvas protected by a waterproof coating, the whole covering to the passage between the cars being flexible like a concertina.

To attempt describing the machinery in use in these works would be to give details of all the newest and most approved appliances that have been perfected by the mechanical genius of the country for facilitating the finish of every kind of material used in car construction. As we linger in the planing mill trying to select machines as being worthy of special notice we finally conclude that the collection as a whole is matchless; in the iron-working machine shop we become convinced that we can not suggest any addition that would add to the efficiency of the plant. But Mr. Bissell, our escort, is less neutral, and he directs attention to the merits of two Bement & Miles car wheel lathes, which were at work. This is the tool that takes hold of the axle between the wheels, the centers taking in the ends of the axle as usual. Work can be done very rapidly without danger of springing the surface out of true. The tool is said to be worthy of all claims made for it. There is a very fine electro-plating department in the works, where all sorts of gold and silver plating is done; in another place there is glass embossing and artistic glass cutting done, and mirrors are silvered and all sorts of operations pertaining to glass are performed. There is a marble cutting department, where the marble work for the cars is finished. There are very extensive upholstery rooms, where old cushions and every thing in the car upholstery line that becomes faded are renovated, and where the finest new work is transformed from the raw material. In fact, the works are a manufacturing establishment where every thing needed for a palace car is manufactured from the raw material.

WEST SHORE RAILROAD SHOPS AT BUFFALO.

There is a large terminal round-house and division repair shop belonging to the West Shore Railroad at Buffalo, which are notable for the clean and orderly condition of shops and surroundings, a state of matters by no means so universal as might be desired. Mr. James Macbeth, the master mechanic, is a young man with strong views in favor of cleanliness and order, and he imprints the stamp of his taste upon the place. The feed water used by the locomotives running on this division must be exceedingly bad, for we saw some specimens of scaling up of flues and other heating surfaces of engines in the shop that were as bad as anything we have ever seen. A brief visit to the New York Central Railroad shops here convinced me that they do not suffer nearly so much from bad water, especially with their passenger engines, as the West Shore people do, although both roads traverse the same region. Some investigation of the cause for the difference brought out the fact that it was owing to the N. Y. C. engines having much larger tanks than those belonging to the West Shore, which enables the former engines to avoid the worst of the water stations. It will be remembered that when Mr. Howard Fry designed the West Shore engines, he specified small tenders with the view of reducing the dead load to be hauled, his intention being to have the engines take water frequently when running by taking it up from troughs laid in the middle of the track.

In many places where the locomotives suffer badly from the effects of impure feed water, defective methods of washing out is greatly to blame, but here the facilities for cleaning boilers are exceptionally good, and the importance of utilizing them to their highest capacity is fully realized. They have steam pumps that maintain a water pressure of 60 pounds per square inch, and great care is exercised in having openings in the boilers to admit the pressure of water to the points that need a scouring rush of water.

They have a drop pit in connection with one of the pits in the round-house, which Mr. Macbeth speaks very highly of. The standard eight-wheel engines belonging to the West Shore Railroad have no less than 34,000 pounds on the leading truck, and they experience great difficulty in getting the axle-boxes to run cool. With the greatest care, there is more or less trouble, and the drop pit is found a great convenience, as a truck can be changed in a few minutes. They have never been able to run the brass bearings of these engine trucks on the journals. Two strips of Babbitt that project clear of the brass are employed, and when these bearing strips get worn down near the level of the brass, they must be changed. If the brass is permitted to reach the journal, a hot box is the result. It causes a great deal of labor, and wears the journal rapidly, but it is the only way they have found to keep the box running cool.

The officers of the West Shore road do not say any thing against the engines belonging to the first equipment, but it is easy to glean that they are in bad repute. The eight-wheel engine designed by Mr. Soule for the road is very highly spoken of, and is a great favorite compared to the other eight-wheelers. There are a few ten-wheel engines there of Mr. Buchanan's design which are said to be much more efficient for hauling heavy trains than the consolidation engines that are the standard for freight.

SCHENECTADY LOCOMOTIVE WORKS.

Like all other locomotive works, these are extremely busy at present, and are working day and night. When I was there they were working principally on eight-wheel engines for the Atchison, Topeka & Santa Fe, cylinders 18 × 24 inches; on ten-wheel engines for the Colorado Midland, cylinders 19 × 26 inches; and consolidation engines for the Richmond & Danville, cylinders 20 × 24 inches. The latter engines are notable for their great size and high center of gravity. Among the work on hand is the building of three "Strong" locomotives, two for the Atchison, Topeka & Santa Fe and one for the Michigan Central.

They are engaged on several improvements which will greatly increase the capacity of the works and will facilitate the economical production of finished locomotives. They have just finished an addition of 100 by 150 feet to the boiler shop and put in the most approved tools for effective labor saving in boiler making. In connection with the addition to the boiler shop they are making changes by which the travel of the overhead crane will be increased 75 feet, making an entire travel of 200 feet. They are putting in a new steam riveting machine with cylinder 42 inches diameter, worked with steam of 100 pounds pressure. This will enable the operator to put a pressure of nearly 70 tons on each rivet. Among the new tools in this shop that are likely to attract a mechanical man's attention is a new automatic multiple punch for tank work which does wonderfully quick work. They have a new 4-spindle drill for flue sheets, a new very powerful punch and shears, and they are putting in a new upright tubular boiler to supply steam for the shop. They are erecting a new blacksmith shop 85 by 350 feet, and intend equipping the shop with the best tools that can be procured for helping out blacksmith work. For the use of the whole works they are putting in a high speed engine to run an electric plant. There will be 840 incandescent lights, maintained by two Edison dynamos.

Nearly all locomotive building works, as well as other mechanical manufacturing establishments, have features peculiar to themselves, and in looking round the Schenectady Locomotive Works I received the impression that their peculiar forte was the quantity of work done by milling, and next to that the numerous operations done in boring machines that in most shops would be turned in a lathe. They also make good use of various kinds of grinding apparatus. Like most of the shops using large milling cutters extensively, they have had considerable trouble with breakage of the expensive cutters, and they are now making all their larger cutters in sections, which prevents the breakage. Making sections of milling cutters is a job requiring a high grade of mechanical skill, but it pays to employ men who can execute the work in first-class style. The large plain cylindrical cutters are made in a very simple way. A cylindrical piece has tapered slots planed parallel with its axis. The cutter is fitted into this slot, and when the tool gets worn, the cutter is driven further in, far enough to bring it up to the original diameter, something like an expanding reamer. The plan is of course well known in most large shops, but to not a few of our readers the method will be novel, and for them the description is written. Rod brasses are practically finished by milling in a Brown & Sharpe machine. All rod keys are made from bar iron. The rough piece is secured in a tapered chuck and milled to the proper shape and size. This is merely given as one out of many instances where they take the rough bar iron and machine it into finish, the practice being followed in every case where machining was found to be cheaper than forging, and they made careful investigation to find out the relative cost of each process. They employ with decided success the Newton duplex milling machine for finishing guide blocks and other work where two parallel faces can be worked at once. The guide blocks are made out of the solid block. The required lengths are slotted off from a bar of the required size, the pin is rough turned in the lathe, and the piece is then placed in a jig and the flat surfaces finished in the milling machine mentioned. Special jigs for holding work are used to great advantage, and by the aid of these appliances many complex operations are repeated with absolute accuracy, the system that has proved so successful in sewing machine manufacture being here applied to heavier work, evidently with equal success. All the heavy milling machines have a small pump attached, which keeps a constant stream of water pouring on the cutter.

A planer is used with a grinding attachment for truing guides and other flat surfaces after they have been case hardened. The emery wheel used for this and several other purposes is a cast iron disk with the periphery scored with deep cuts. This rim is then run in a mixture of emery and glue till a good coating is put on. An emery wheel of this kind is very cheap, and works well in dry weather; but when there is much moisture in the atmosphere it works indifferently. They have two water emery grinders in use, but they are experimental and it is yet undecided whether or not they will merit being adopted.

They use a water-flooded tumbler for cleaning brass castings. It is like the noisy nuisance used for cleaning flues, but smaller. It makes an excellent job, and every particle of brass is saved from the water by simple sluices. The castings that pass through this process are so free from sand that the tools used in working the brass last much longer than they do with brass cleaned in the ordinary way.

The workmen in the various departments work largely by piece work, and most of them make excellent pay, and have no use any more for payment on the day basis. The operations are carried on in such a way that there is personal responsibility for every job being well done; and the different workers are interested in preventing defective work. From the time a piece starts out in the rough, until it reaches the finished engine, it is constantly passing through hands which are sure to be held responsible if defects due to their operation are discovered. Let us follow the manipulations of a cylinder till it is ready to be bolted to the frame. One or more cylinders are wanted for a certain type of engine, and a card is sent from the office to the pattern store room, requiring the pattern of a given number to be sent to the foundry, and the foreman of the foundry is directed in a similar way to make the casting. Both foreman of foundry and storekeeper of patterns are responsible for the pattern being that denominated in the card. The casting is made in dry sand of a selected mixture of charcoal iron. It is then cleaned and inspected, after which it is taken to the part of the machine shop where cylinder work is done. First it is bored, the ends faced and the flanges turned. From the boring mill it goes to the planer, where it is secured by the flanges resting on Vs and the planing done, all except the valve seat, which is planed by a special shaper. It is then taken to the drill-press and all holes drilled, the operation being guided by templates with hardened bushes. The cylinder is then ready for bolting to its mate, and this is done on a large surfaced block, which gives easy means of proving if every thing is parallel. A record is kept of the various men who have done the different operations, and any thing defective found would fall back upon them.

It will further illustrate the system of doing work to follow another piece from beginning to the finish. A good representative article for this purpose is a reversing link. In the first place we find it in the engine drawing in the drawing office designed to suit the proportions of a certain class of locomotive. The primary movement to getting a link or set of links made, is to prepare sketches for the forgings. These are made on heavy buff paper, each part occupying a sheet 7 × 10 inches. The dimensions are closely inspected, the sketches traced into a book kept for the purpose in the drawing office. Each sketch is then numbered and entered into the blacksmith shop forging sheet to be worked from. Meanwhile a detail drawing taken from the engine drawing is prepared and bound in a book which is kept in the drawing office. A copy of this is made on a card 12 × 18 inches, for the use of the machine shop, and there supplies particulars for the various operations. When the forging comes from the blacksmith shop, it is milled to the thickness required, and the faces planed

to the proper radius on a radius planer. It then goes to the vise and the outside lines are laid out, after which it is milled on a circular mill to the required outside dimensions. It is now fitted to the filling pieces, clamped together and drilled for end bolts. When these bolts are put in, the link goes on to the milling machine again and the ends are dressed off. The joint and saddle holes are now drilled to gauges, after which the link is ready for case hardening. This is done with cracked bone and salt, in a close box which is kept hot for 18 or 20 hours. After hardening, it goes to the vise to be straightened, ground and the block fitted in. The offset of pin on the saddle is taken from the engine. The saddle is forged from the solid, turned, faced and milled. The sliding block and plate are forged in bars, curved to about the right radius, milled, planed and slotted off into the lengths wanted. When it is finished the link is sent to the erecting floor. All the iron used is of the best hammered quality.

To some readers these may be tiresome particulars, but they will be of interest to those who have not the opportunity for themselves of watching the manufacturing of locomotives and noting the systematic way it is done.

DELAWARE & HUDSON CANAL SHOPS AT ONEONTA.

Oneonta is a delightfully situated little town in a beautiful valley formed by the hilly upheavals that stretch westward from the Catskill Mountains, and the town owes any prosperity it possesses to its being the mechanical headquarters of the Delaware & Hudson Canal Company. Of course all our readers know that the aforesaid "canal company" is a highly prosperous railroad company, and the first in America to own a locomotive, the famous "Stourbridge Lion," which was sent from England by the venerable Horatio Allen and run by him on one solitary trip over a part of what is now this company's railroad system. The Stourbridge Lion has now many handsome and stalwart successors, and as they are kept in vigorous life by the work done at Oneonta, I made a pilgrimage in modern fashion to that attractive place. Not by the rural blandishments, however, was I attracted, but by the fame of certain hydraulic machinery in use in the machine shops. The town has water-works which, by gravity, give a hydrant pressure of about 60 pounds to the square inch; and this has been utilized by the mechanical officers of the Delaware & Hudson Canal Company to do nearly all kinds of lifting. In the engine erecting shop they have a stall which has four upright hydraulic cylinders conveniently set for lifting one engine. They are so fitted that they can be moved parallel with the track, so that a short or long engine can be handled with equal facility. The cylinders can be used separately or simultaneously. When an engine has to be jacked up, it is taken into this pit, the hydraulic cylinders are placed in the proper position, water is let in by opening a valve, and the engine moves up slow or fast, as the operator desires. If the wheels are to be taken out and removed, the engine is lowered upon small tracks and transferred to another track, and the hydraulic track is ready for the next candidate for elevation. While I was there, an engine was on blocks in the hydraulic track waiting for her driving wheels, which were ready on the track behind her. They raised the engine, put in the wheels and lowered the engine so that she rested on the axle boxes all in fifteen minutes. Various kinds of power presses used in the shop are operated by the water power got in this way, and in the car shops there are several sets of jacks used for raising cars that are operated in the same fashion as the hydraulic cylinders. A hose is used for making the connection and a common Westinghouse air-brake coupling is employed to connect the hose. Those using this arrangement say there is no trouble from leakage. In the yard there is a crane for lifting heavy work, operated by a long hydraulic cylinder, the arrangement being somewhat similar to the way some hydraulic elevators are operated.

They have a very efficient fire service in connection with these shops and the men are drilled frequently to keep them in practice. When I was there the fire-alarm was sounded and the company belonging to the blacksmith shop were out and had a stream flying in 13 seconds. The last stream going was at work in 20 seconds.

After the hydraulic apparatus, the most notable thing about the shops is the neat, clean and orderly condition in which they are kept. The vacant patches of ground between the shops, which in divers cases are devoted to the repose of dilapidated castings and ancient forgings that lie in forgotten retirement amidst greasy waste, battered oil cans, superannuated hoses, old shoes, and in company of the inevitable bull-nose with a broken flange, are here cleaned up and turned into smiling flower gardens. This thing is an innovation worthy of wide imitation.

Mr. R. C. Blackall is superintendent of motive power of this road, and Mr. Thos. Howard is master mechanic and Mr. J. R. Skinner master car-builder at Oneonta.

CANADIAN PACIFIC SHOPS AT MONTREAL.

A pleasant but brief visit paid to these shops showed me that the methods of doing work are similar to those found in vogue in all first-class shops in the United States—that is, they have adopted the American systems of shop work; but the extent of the operations carried on are planned after English practices. The railroad company aim to make their shops their manufacturing establishment, where nearly every thing required for construction and maintenance shall be made from the raw material. This greatly increases the magnitude of Canadian shops, compared with those of roads having the same quantity of machinery to maintain in the United States. It is probably economical for Canadian railroad companies to make their own fittings for locomotives ans cars instead of buying them from manufacturers making a special business of such work, but it has not been found a paying plan in the United States.

The Canadian Pacific shops are equipped with excellent machinery well arranged. The machine tools are mostly of British make, very substantial in appearance, and withal good tools to do work on accurately. Some of them are more noisy than similar tools of American make, which is due to the use of uncut gearing. The shops are particularly well provided with the means for handling heavy material by power. An overhead crane is used in the erecting shop for carrying engines or boilers to the positions where work has to be done. The machine shop, which is alongside of the erecting shop, is traversed by a jib crane which handles heavy work for most of the tools. The arrangement of these shops is very much the same as those of the Chicago, Burlington & Quincy at West Burlington. The shops are well provided with the best kinds of small tools, precision gauges, templates and jigs. I noticed that flexible drills were used for a great many purposes, the shafts used being telescoping tubes with universal joints. To attempt to decribe the various operations seen going on would be to repeat what I have already attempted to describe as having seen done in other good shops. The blacksmith shop is particularly well equipped with formers, and they possess the novelty of being made of cast steel. Mr. Brown, mechanical superintendent, found that the cast iron formers broke so often that the renewals became an important item of expense besides causing delay, so he tried cast steel for the purpose and found it so satisfactory that he adopted it as a standard material for formers.

GRAND TRUNK RAILWAY SHOPS AT MONTREAL.

In the course of a pleasant visit with Mr. Herbert Wallis, mechanical superintendent of the Grand Trunk Railway, I was shown the records of a great variety of experiments they had made to ascertain the economy or otherwise of using various forms and material, and I received the impression that the railroad companies of America that are still groping in the dark about the utility of adopting certain things would be very much enlightened if they could receive the information acquired by the Grand Trunk Railway. They have, for instance, the best, most accurate and fullest record of steel tired wheel service of any company in America. They have a good recording system, and it has been well kept up for many years. When any improvement is brought before the mechanical officers as being worthy of adoption, it is examined, and if found promising of success is given a trial and a close record kept. Upon this record depends the rejection or the adoption of the device. When the extension smoke-box as a spark arrester was first tried a few engines were equipped with it and put in competition in similar service with engines of the same class having diamond stacks. From all parts of the system and from all kinds of service where this test was going on, the testimony came in pointing to the fact that the extension smoke box saved about 8 per cent. of fuel, compared with engines having the diamond stack. These experiments were protracted and thorough, and led to the decision to adopt the extension front as the standard spark arrester.

The car and locomotive shops belonging to this company constitute what appears to me to be the largest mechanical headquarters belonging to any railroad company on the American continent. They have some of the finest machinery for railroad work that I have ever seen, but the arrangement of the locomotive shops makes a mechanical man melancholy and leads him to reflect on what a blessing to the company a disastrous fire would be. The place has "growed" like Topsy, but "growed" much bigger than nature or man's original plan anticipated. Mr. F. L. Wanklyn, assistant mechanical superintendent in charge of these shops, must have an arduous task getting work carried on cheaply, laboring under the disadvantages that badly-arranged shops entail; but he appears to secure a good showing nevertheless. For thirteen years Mr. Wallis has maintained the motive power and rolling stock belonging to the road entirely from revenue, all renewals being charged as maintenance, and the machinery has been kept up in first-class order, bettering rather than depreciating. At present there are over thirty engines in the shop undergoing repairs, some of the work being equivalent to rebuilding. They are working to reduce their motive power to four classes. A large proportion of the engines in the repair shop have plate frames, but they are not putting that form of frames on any of the new engines. The boiler shop of these works has the best equipment of boiler-making machinery that I have ever seen in a railroad shop. Riveting, flanging, punching and shearing are all done by hydraulic machinery.

The car shops presided over by Mr. Wm. McWood appear to be more modern than the locomotive shops, or the original plan has been susceptible of more harmonious growth, for they are well arranged and compact for such large buildings, the passenger car building and repair shop being no less than 1,000 feet long, with three tracks and room between for a narrow gauge track, which is used for the transportation of material.

They are very busy in the shops at present and are building among other things two exceedingly handsome Pullman cars 65 feet 2 inches long. The inside is finished in mahogany and the carving work is very elaborate. The cars are carried on six-wheel trucks with 42-inch wheels of German make. They are heated by the Baker heater and lighted by the Julien electrical system with storage batteries. The lighting apparatus alone of each of these cars is said to cost five thousand dollars. They are building a number of first-class day passenger cars of their ordinary pattern. They put up an unusually strong framing, and the seat plank is so designed that it acts as a strong truss to keep the middle from sagging. A lining of heavy paper thickly painted is put under the sheeting of these cars, and is said to aid materially in keeping out the cold. They are building a new style of horse car for the transportation of fancy equine stock. It looks like a baggage car, but is divided up into stalls that are thickly padded. Nearly all fittings for the building, equipment and repair of cars are manufactured in these shops from the rough material.

My remaining notes on the continuance of the trip must lie over to another issue. A. S.

Cost of Building Locomotives.

BY FRANCIS R. F. BROWN, M. E.

The cost of a finished locomotive necessarily depends to a large extent on the design, class and materials used in its construction, and to insure success in economy of production the designing and building departments should work together in harmony, and under an undivided authority; so that while on the one hand any improvement in design, or means of cheapening construction which may be brought to light by shop experience may be considered by the head of the department, and if advisable adopted without being blocked by the draughtsmen, who as a rule forcibly object to their designs being interfered with or their drawings altered; yet, on the other hand the draughtsmen should be allowed free access to the shops, and full opportunity given them to inspect the work as it goes on, and to report to the superintendent whenever they find that drawings are not adhered to, inferior workmanship is being allowed, or materials used such as are contrary to specifications.

Under such circumstances, combined with some years experience in building the class of engine described, the results given below are attained in Canada by the writer:

The engine is an eight-wheeled road engine, American type, cylinders 17 in. by 24 in.; drivers, 62 in. diameter. Boiler pressure, 160 lbs. to the square inch, and weight of engine in working order, 87,000 lbs.

The weight of the engine empty is 77,400 lbs., and that of the tender 30,100 lbs., making a total of 107,500 lbs., and the cost of ten engines, lately built with 10 per cent. added on to both material and labor, was $5,740 each, or 5.34c. per lb., this cost including a complete set of tools, jacks, lamps, headlight and U. S. packing in pistons and valve stems. Some of the principal detailed costs with 10 per cent. added to both material and labor are given below.

Frames.—Both back and front frames are forged from No. 1 scrap, they weigh when machined and finished ready for the erecting shop 4,220 lbs. per set, and cost 5.3c. per lb.

Boiler.—The finished boiler, without tubes, weighs 14,680 lbs. and costs $1,116, or 7.6 cts. per lb.

Cylinders.—Fitted up ready for erecting, with steam chests, all covers and studs weigh 5,460 lbs. per pair, and cost $800, or 5.5 cts. per lb., with castings at 3.90 cts. per lbs.

Wheels, Axles and Tires.—Finished ready to put under the engine, weigh per set for the engine, 12,440 lbs., and cost $517.46, or 4.16 cts. per lb.

Crank Pins.—Are made from Low Moor iron and case hardened, they weigh per set of four, when finished ready for use, 287 lbs., and cost 10.5 cts. per lb.

Side Rods.—Are made with ends and oil cups forged solid, then slotted out and fitted with half brasses and cotter, and when complete for erecting weigh 580 lbs. per pair, and cost $87, or 15 cts. per lb.

Brass Boiler Mountings and Fittings.—Including injector, check and steam valves, whistle, water gauge mountings, try cocks, etc., cost on the average 35 cts. per lb.

Smoke Stack.—With cast iron top, fitted with netting and cone ready for use. Weighs 930 lbs., and costs $87, or 4 cents per lb.

Cab.—The cab, fitted with doors and sashes glazed, weighs 750 lbs. and costs $85.

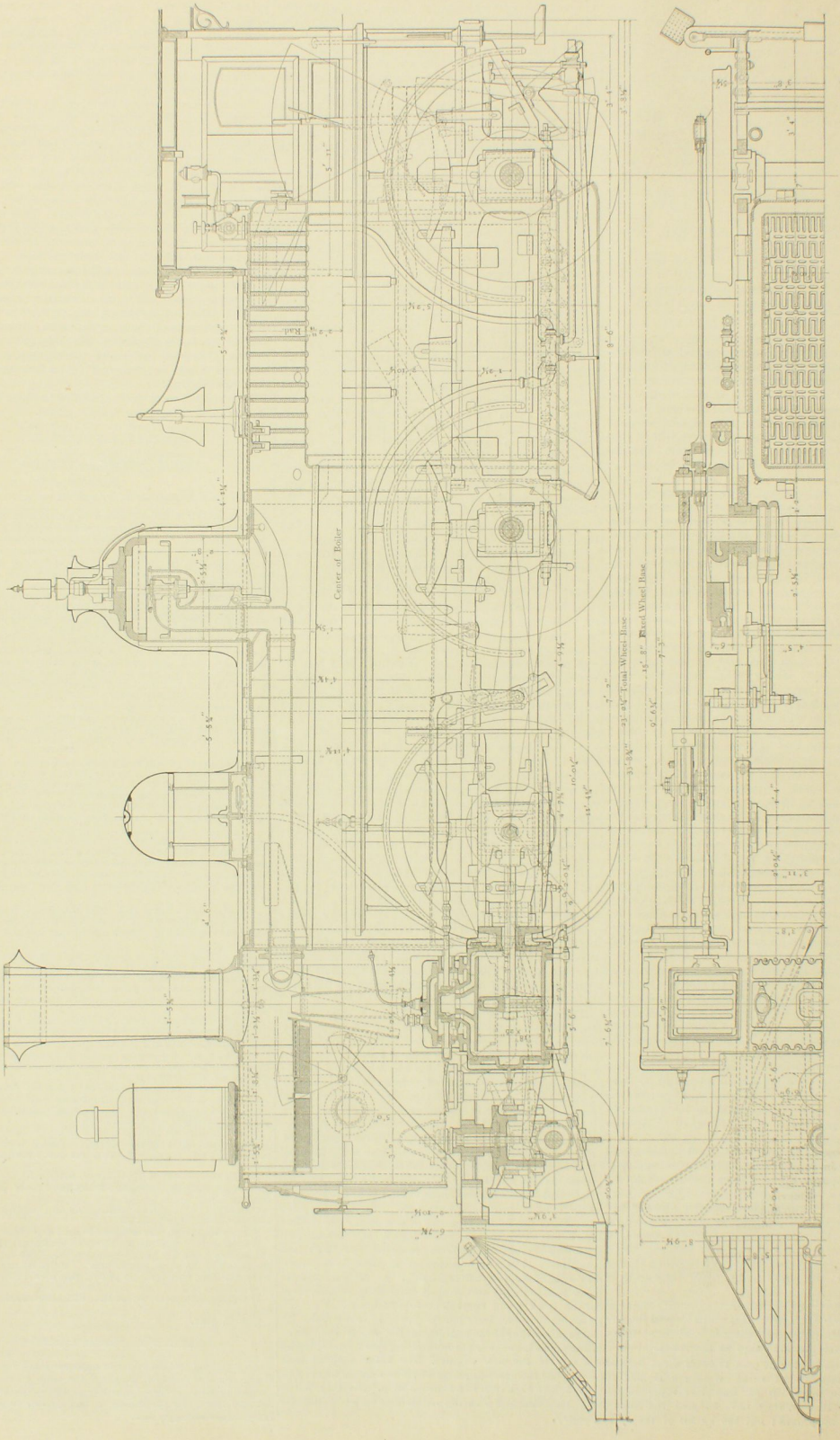
Pilot.—Ready for use weighs 420 lbs., and costs $14.

Tender.—The tank is so designed that every rivet in it can be closed by the hydraulic machine. The capacity of the tank is 2,800 imperial gallons. The trucks are made of wrought iron, with semi-elliptic spring, and the frames are of oak.

It weighs, complete, 30,100 lbs., and costs $924, or 3.07 cents per lb.

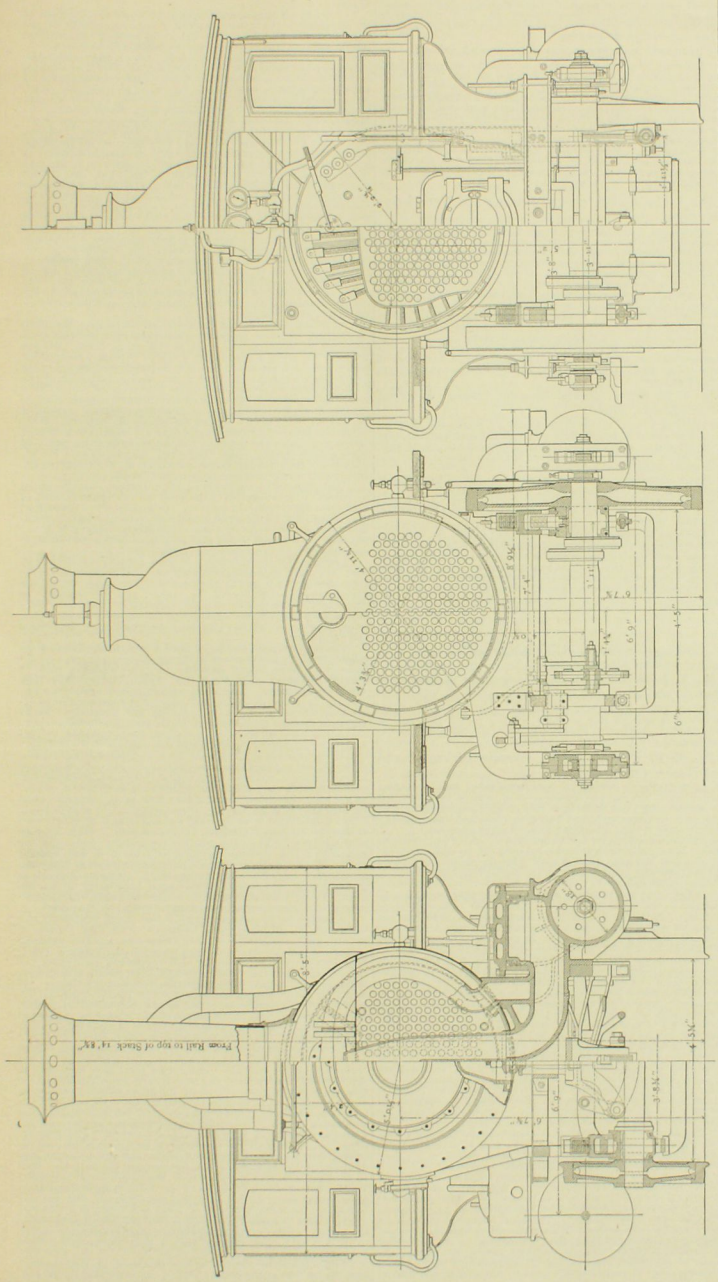
OCT. 8, 1887.

It is a painfully pleasant duty to announce that "George" (not George, the land reformer) has joined the noble army of steam railroad presidents, with headquarters at Pittsburgh, but he has not surrendered his commission as high private in the nobler army of railroad supply men.



STANDARD FREIGHT LOCOMOTIVE—GRAND TRUNK RAILWAY.

Designed by Herbert Wallis, Mechanical Superintendent.



STANDARD FREIGHT LOCOMOTIVE—GRAND TRUNK RAILWAY.

The accompanying cuts illustrate a class of locomotive which Mr. Herbert Wallis, mechanical superintendent of the Grand Trunk Railway, has designed and adopted as standard for freight traffic. The engine appears to strike a happy medium between the awkwardly heavy and the weakly light freight locomotive, and is said to give the highest satisfaction in service, not only in convenience in handling trains, but in efficiency and durability.

The cylinders of this class of engine are 18 × 26 inches, and the driving wheels are 62 inches diameter. It will therefore be found that the tractive force at the rail per pound of mean effective pressure is almost 136 pounds. The working boiler pressure is 150 pounds per square inch. Taking 85 per cent. of this as available for doing work in the cylinder, the rule laid down by the American Railway Master Mechanics' Association, the working power for turning the driving wheels will be 16,830 pounds. The weight on the driving wheels is 80,416 pounds, which gives 4.7 as the co-efficient of adhesion, as compared to 4.25 recommended in the Master Mechanics' formula.

The boiler is straight, 50¾ inches diameter at smallest ring, is provided with extension smoke box, and provides 1,231 square feet of heating surface, 116 of this being in the fire-box, which has a grate area of 17,664 square feet.

The total working weight of the engine is 96,376 pounds, which is distributed as follows: Pony truck, 15,960 pounds; leading drivers, 28,448 pounds; middle drivers, 27,216 pounds; and back drivers, 24,752 pounds.

The following are a few of the leading dimensions and particulars about the engine:

Kind of fuel used	Bituminous coal
WEIGHT AND GENERAL DIMENSIONS.	
Gauge of road	4′ 8½″
WEIGHT OF ENGINE IN WORKING ORDER.	
Weight on truck	15,960 lbs.
" driving wheels	80,416 lbs.
Total weight	96,376 lbs.
Total wheel base of engine	23′ 2½″
Rigid " "	15′ 5″
From center of cylinder to center of main driving axle	11′ 4¾″
From center of main driving axle to center of leading axle	7′ 2″
From center of main driving axle to center of trailing axle	8′ 6″
From center of main driving axle to center of pony truck axle	14′ 8¾″
From center to center of cylinders	6′ 0″
" rail to center of boiler	6′ 7¾″
" " top of smoke-stack	14′ 8½″
Length of main rod	7′ 3″
CYLINDERS, VALVES, ETC.	
Diameter of cylinder	1′ 6″
Stroke of piston	2′ 2″
Kind of piston	C. I. box
" " packing	C. I. rings
Sprung in., size	¾″ × ⅛″ thick
Diameter of piston rod	3½″
Size of steam ports	16″ × 1¾″
" " exhaust ports	16″ × 3¾″
Balance slide valves.	
Travel of valve, full gear	5¼″
Lead " "	5/32″
Outside lap valve, full gear	¾″
Sectional area of each steam pipe	17.72 sq. in.
WHEELS, ETC.	
Diameter of driving wheels	5′ 2″
Steel tires secured to wheel centers with tire bolts.	
Diameter of C. I wheel centers	4′ 8″
From center to center of bearings (L. D. & T.)	3′ 11″
Diameter and length " "	7″ × 8″
" " " of wheel seat	7″ × 6⅝″
" " of main rod bearings	4″ × 5″
" " of side " (L. D. & T.)	4″ × 3″, 4¼″ × 3½″ and 4″ × 3″
Diameter of crank pin seat	4½″
" of truck wheels	3′ × 1″
Steel tires secured to wheel centers with solid clip and tire bolts.	
Diameter of C. I. wheel centers	2′ 8″
From center to center of bearings	3′ 8¼″
Diameter and length of bearings	5″ × 7⅛″
" " of wheel seat	4⅞″ × 7″
SPRINGS.	
Length of L. D. & T. springs from center to center of hangers	2′ 10″
Number, width and thickness of plates in each spring	9, 3½″ × ½″
Length of pony truck springs from center to center of hangers	2′ 6″
Number, width and thickness of plates in each spring	7, 3½″ × ½″
BOILER.	
Description of boiler: Straight back and extension smoke-box.	
Size of fire-box outside, length × width	6′ 9″ × 3′ 6⅝″
Length of barrel	11′ 2¼″
Inside diameter of smallest ring	4′ 2⅝″
Material of barrel and outside casing of fire-box	Iron.
Thickness of barrel plates	7/16″
Kind of horizontal seams	Butt joints, inside and outside welts double riveted.
Kind of circumferential seams	Lap joints, double riveted.
Material of tubes	Charcoal iron.
Number of tubes	212
Diameter of tubes outside	1¾″
Thickness of tubes	No. 12 B. W. G.
Pitch of tubes, smoke-box tube plate	2½″ diag'l, 2⅜″ vert'l.
Distance between tube plates	11′ 5⅛″
Size of fire-box inside, length × width × depth from underside of crown plate to bottom of foundation ring	6′ 0⅝″ × 2′ 10⅝″ × 6′ 0½″
Water space, front, sides and back	3″
Thickness of outside casing plates, throat, saddle, sides and face	⅛″, 9/16″, 7/16″ and ¼″
Thickness of smoke-box tube plates (iron)	¾″
Section of angle iron ring connecting barrel to smoke-box tube plate	5¾″ × 3¾″ × ⅜″
Diameter outside smoke-box	5′ 0″
Length of smoke-box, from joint face to smoke-box tube plate	5′ 9″
Material inside fire-box	Steel.
Thickness of plates, tube, crown, sides and back	9/16″, 5/16″, 3/8″, 1/2″
Fire-box crown stayed with direct screw stays.	
Diameter of do	1⅛″
Distance from top of crown plate to underside of saddle plate	1′ 3⅝″
Diameter of dome, inside	2′ 5½″
Height of dome	2′ 8″
Maximum working pressure per square inch	150 lbs.
Kind of grate	Rocking.
Width of bars	1″
" openings between bars	⅝″
Kind of blast nozzle	Single.
Diameter of blast nozzle	4¼″
Boiler, cylinders, cylinder covers, saddle back, front and bottom clothed with silicate cloth.	
TENDER.	
Wood frame.	
Front truck fitted with center bearing springs.	
Back truck fitted with center and side bearing springs.	
Number of wheels under tender	8
Diameter "	3′ 1″
Material: C. I. centers, steel tires with solid clip and tire bolts.	
From center to center of bearings	6′ 4″
Diameter and length "	3½″ × 7″
" " " wheel seat	5⅝″ × 7¼″
" in center of axle	4⅝″
From center to center of trucks	10′ 6″
" " truck wheels	4′ 8″
Total wheel base of tender	15′ 2″
Water capacity of tank, imp. galls	2,500
Coal " in pounds	20,000
Total weight of tender, pounds	74,600
Total wheel base of engine and tender coupled	46′ 0⅝″
Total length of engine and tender from nose of pilot to back of draw-bar casting	50′ 0⅝″

Good Automatic Brakes Preferable to Brakemen.

Shortly after the Baltimore & Ohio Railroad accident happened in Washington, where through the failure of a straight air brake a passenger train jumped the track with disastrous results, the *Gazette* "seriously pondered" the occurrence through a two-column article, and concluded that the only means at the command of railroad managers to insure the safe operating of passenger trains was to maintain a large force of well-trained brakemen on every train ready to do the work of braking when even the best brake failed. The recommendation was contrary to all ideas of modern progress, and was on a par with the work of the inventor who wishes to place an apparatus at the front and rear of each train to sustain the shock of a collision, or of the crank who wishes to run a courier locomotive ahead of each train to ascertain that all bridges are in safe condition. The accidents which have been so numerous during the past year have been productive of a crop of wild enough safety schemes from impracticable busybodies of the daily press, and railroad journals ought to be careful about swelling the number; for an important portion of the traveling public look to the railroad papers for safe council on disputed questions relating to safe methods of railroad operating. Drawbridges, grade crossings and terminal stations are approached daily in perfect safety by thousands of trains, and the automatic air brake stops them all with as much certainty as the locomotive produces the power to start the trains again; and the railroad officers or the traveling public have no thought of raising a question of the operation being safely done. This has been going on all over the country for ten or fifteen years, as safely as any mechanical operation has been performed; and it is rather late in the day to begin calling for a staff of brakemen to perform duties that might become necessary once in ten years.

Considerable experience with the automatic air brake has convinced us that it never fails without a premonition which will give sufficient warning to a careful man in time to prevent accident. We consider that passenger trains are sufficiently manned for all purposes of safety, but we hold that better training for the men is necessary, not in twisting hand brakes, but in the aid to comprehending the details of the increasing complexity of train mechanism, so that they may have the knowledge which will quickly lead to the detection of growing defects that would entail the failure of a brake or other important apparatus. Holding these views we addressed a few leading railroad managers to see how far our impressions were sustained by the men in authority, and all the gentlemen gave us courteous replies; but some of them declined to have their answers published. Several of the general managers went quite fully into the subject, the information supplied by Mr. E. B. Thomas and others being very valuable. The following are a few of the replies we received:

Mr. J. T. Harahan, general manager of the Louisville & Nashville Railway, writes:

"Replying to your favor of Aug. 29 I will state that we have given the matter of air brakes, particularly the Westinghouse automatic air brake, considerable attention, and our experience with them has been very similar to yours.

"I do not see how it is possible for the Westinghouse automatic air brake to fail without giving warning. If there is a defect in the pipes the pump should stop, or a triple valve get out of order, sufficient warning would be given to prevent an accident. I have known a great many cases where serious accidents have been prevented by the use of the Westinghouse automatic air brake; and the conductors' valve, I know from personal experience, to be an efficient mode of applying the brakes in case of danger. There cannot be a failure that would be at all serious, unless it is the stopping of the air pump, or the leaking of the pipes in such a manner as to render it impossible to stop the leak; and these, of course, give sufficient warning to the trainmen.

"I do not know any source of danger which you have overlooked in your paper, and am glad that you have taken the matter up.

"In the case of a non-automatic brake, I can understand how failure could take place; and, if the brakes are kept in proper order, I cannot understand how such an accident as the one referred to on the Baltimore & Ohio road could happen.

"I therefore do not deem it necessary to keep a force of brakemen on each passenger train, to be ready for the alleged emergency of a brake failing without warning.

"We use exclusively the Westinghouse Automatic Air Brake on our passenger trains."

Mr. A. A. McLeod, general manager Philadelphia & Reading Railroad, writes:

"Your letter of Aug. 29th has remained on my desk unanswered simply because I have not had the time to answer such questions, which are so suggestive, and to reply fully would cover a great deal of ground. I will only state that my experience with the Westinghouse brake has been very satisfactory, and in my judgment it will never fail if it is given a fair chance by proper attention, which we find absolutely necessary for safety with not only brakes but with all other machinery which go to make up a passenger train."

Mr. James McCrea, general manager Pittsburgh, Cincinnati & St. Louis Railroad, writes:

"I am in receipt of your favor of Aug. 29, and in reply would say that in my judgment, where the Westinghouse automatic is used on passenger trains, there is no necessity for gauging your force of brakemen, so as to be ready for an emergency, consequent upon the brake failing without first giving some indication that it could not be relied upon. I know of only two ways in which the brake can fail without giving warning. The first is, where the stop valve in the train pipe has been closed while the train is in motion, by a piece of ballast being thrown against the handle of the valve. As a protection against an accident of this kind, however, many of the roads guard the handle of the valve with shields. The other way is, when the proper stops have not been placed to prevent the engineer from throwing the handle of his three-way cock around too far. Of course, you will say, nothing but gross carelessness would bring about such a condition of affairs, and yet we had an accident about three or four months ago which, beyond question, was caused by a defect of this kind. The engine was an old one, of the Rhode Island build, and it was demonstrated that the handle could be thrown around so far as to release the brakes after having first applied them.

"P. S.—I have heard it claimed, but never knew of an actual case, that upon a very cold day, following a time when considerable moisture had been in the air, that it was possible for a little piece of ice to form in some of the larger openings connected with the service pipes, and be sucked into the small openings at couplings or cut-off plugs, and thus preventing the flow of air so as to interfere with its working."

The general manager of a prominent road writes:

"Upon my return to office, after an absence of several days, I find your letter of August 31st. I should not care to be quoted publicly on the matter you present, but for your personal information I will say that my experience with the Westinghouse automatic brake has been almost identical with your own. I cannot recall a case where the brake has become defective without giving due warning, and whilst I am not positive, I am quite doubtful whether such state of affairs could arise.

"It would be a matter of much interest to me to see this subject discussed, pro and con, by the prominent railroad journals of the country, and if your inquiries are with that view, I shall look with much longing for the matter."

Mr. H. L. Morrill, general manager St. Louis & San Francisco, writes:

"Answering your favor of Sept. 2, would say I have never known the Westinghouse Automatic Air Brake to fail without first giving some warning. If the pipes had been coupled, and there was air in the pipes or reservoir, I do not see how there could be any entire failure of the brake except through gross neglect. There is sometimes a failure to properly release, caused by a leak in the conductor's valve, hose becoming uncoupled, or something of that kind, but no failure to apply the brake unless plain warning has been received. I am of the opinion that it would not be of any use or any check upon danger of failure to have two or three extra brakemen upon the train.

"In the recent B. & O. case, referred to by you, I do not understand that two or three extra brakemen would have been of any avail in the matter, as the time was too short for their efforts to be of any good."

Mr. J. W. Spicer, general manager Chicago & Grand Trunk Railway, writes:

"Replying to your favor of the 3d inst., I beg to say that we have experienced no failure with the Westinghouse automatic air brake other than an occasional bursting of a pipe, or slight failure, of which ample notice was given to the trainmen. We consider the brake in every way reliable.

"The trainmen are, of course, expected to be on to the alert to apply the hand brakes should any emergency arise.

Mr. W. H. Barnes, general manager Boston & Albany Railroad, writes:

"Replying to yours of Aug. 27. In our experience with the Westinghouse Automatic Brake, it has never failed without a warning, and all failures which we have found have been on the side of safety; that is, if the brake is not in order, the train has got to stop, whether we will or not, the difficulty found and remedied before the train can go on. We use the brake for stopping trains at all stations and railroad crossings."

"The state law of Massachusetts requires a brakeman on passenger trains, one for every two cars in the train. We have always complied with the law, whether we thought it really necessary or not. But we have said that while the brakemen had little or no braking to do, he could make himself useful in other ways for the comfort of the passengers, etc."

Mr. J. F. Barnard, general manager Ohi & Mississippi Railway, writes:

"Your letter of the 31st ultimo was duly received. With occasional exceptions, such as stated by you in the last part of your letter, I have never known the Westinghouse Air Brake to come short of doing its duty promptly."

Mr. E. B. Thomas, general manager Richmond and Danville Railroad, writes:

"Acknowledging receipt of your favor under date of the 31st ultc., I beg to say that an unusual press of business has prevented an earlier reply, and that it is only at the moment that I have been able to spare sufficient time from other and more pressing duties to give it such consideration as its merits deserve.

"At once upon its receipt I addressed a copy of your letter to each of the superintendents connected with this system, embracing over four thousand miles of road. Briefly summarized, I give you the following quotations from the replies received:

"One officer states:

"'I have used the automatic air brake since 1874 continuously upon the several roads with which I have been connected since that time, and during this period of thirteen years have had the brakes severely tested on many occasions by having to put it on with full force to avoid accidents. In no instance has the brake failed to perform its full duty promptly. Occasionally some of the minor parts of the brake get out of order in service, but ample notice seems always to be given by leakage or by the valves, and with very few exceptions the men on the train can very readily adjust the valves and repair any imperfections. The failure only occurs after the brakes have been applied and then released, and not before the brakes have been applied, the difficulty being at such times the brakes will not release, not that they will not hold. I do not consider it necessary to put additional brakemen on a train beyond what are necessary for the proper handling of signals, attention to passengers, fires and proper care of train. I consider beyond a doubt that a train equipped with the automatic air brake, carefully inspected and tested both on the locomotive and cars before the train leaves, is all that possibly can be required to insure safety in making the ordinary service or emergency stops. The brakes applied by hand would be of no use whatever in an emergency stop."

"The officer whose experience is quoted above has had a long and continuous service on many of the most important lines in the country, and his opinions are deserving of weight.

"Upon another division the superintendent says:

"'We have been using the automatic air brake for the past ten years. During that time we have never had it fail without warning when there is air in the reservoirs and the pipes connected; in fact it seems to me it would be impossible for it to become so deranged as to cause a failure. The great feature of the brake is that it applies automatically in the event of any bursting of pipes, breaking of hose, connections, etc. On one occasion we had, either by accident or the act of some malicious person, the cock on the tender of an engine drawing one of our passenger trains closed while the train was standing at a station, which was not discovered until the engineer undertook to apply the brake at the next stopping point, when he found it could not be done with the lever used for that purpose; but as all of our passenger engines have what we call a safety cord that runs through the cars, the engineer found no difficulty in applying the brakes with the cord referred to.

"'In my opinion the only emergency making a full corps of brakemen on our passenger trains necessary would be the giving out of the air pump, which is a very uncommon occurrence. This, with the fact that all of our through freight engines are equipped with air pumps and attachments in order that they may be used on passenger trains when necessary, convinces me that a full corps of brakemen on our passenger trains is useless.'

"The superintendent of still another division, composed of 267 miles, upon which there are maximum grades of 80 feet, with sharp curvatures in them, an exceedingly difficult division to work, and upon which emergency stops are no unusual occurrence, says:

"'There has never been a case of accident to any passenger train on my division that could be traced to the failure of the automatic air brake. This brake always gives warning of any leak or break, and the only way that I can see where it would fail to do this, is where some person might turn the cock between the tender and the mail car, or mail and express car, thus cutting off the air from the train, but allowing gauge to show full pressure. The bursting of a hose, the most usual cause of trouble, is easily remedied. The automatic air brake, if properly inspected and cared for, is all that is necessary.'

"The General Superintendent on another Division, referring to the same question, says:

"'I beg to say that in my experience I have seen no failure of the automatic brake that could possibly cause an accident of the nature referred to. A hose will sometimes burst or leak, but that simply puts the brake on or causes it to stick. In no case have I seen a leak prevent the air from going on. I have seen triple valves in bad condition, so they were sluggish in their movement, and did not go on as promptly or let off as quickly as they should have done, but that was always for want of attention. With proper attention from the inspector, proper tests by the trainmen, where trains are coupled, I am led to believe there should be no failure. I do not deem it essential that our passenger trains should be supplied with men constantly at the brakes. Failures, either from bursting hose, which are very rare, or failure of air pumps, or in fact any other failure, give us ample warning. I knew one case where (not upon this road) the air cock at the rear of the engine was not opened to let air to the train, and no test was made by the engineer before starting, and as a consequence he could not stop his train. That was no fault of the air brake, but inattention on the part of the inspectors and trainmen. I believe that any alleged accident of this kind can always be traced to too high speed and a failure of the engineer to apply the brakes at the proper time. We have never had an accident attributable to a failure of the automatic air brake. An additional precaution would be to have all engines supplied with driver brakes.'

"The officer above quoted has had a long and varied experience, not only upon roads of the far West, but upon the trunk lines, and on many of the leading railroads of the country. His opportunities for observation have been large, and his opinion is entitled to great weight.

"As we are operating the automatic air brake upon two divisions having excessive grades, the experience upon those divisions may not be uninteresting. On our Western North Carolina Division we have a continuous grade of 116 feet per mile for twelve miles. Upon the Asheville & Spartanburg Division of the line we have a grade of 237 feet to the mile for three miles. Upon those divisions we use not only driver brakes on the engine, but a retaining or pressure valve on each car which is applied before starting down the grades, and guarantees a continual pressure of ten pounds to the square inch on the wheels of each car. When all of the pressure or retaining valves are applied to a train of five or more cars, the engineer frequently finds it necessary to work a light throttle while descending the mountains. The application of the retaining valves is of course an additional precaution, which we use only on our mountain grades.

"There has not been a single accident nor any damage caused by reason of the non-action of the automatic air brake in time of need upon the divisions in question. Originally there was a good deal of fear that its operation would lead to trouble on our mountain divisions, but experience has demonstrated that this is not the case. It is proper to add that upon these divisions the engines are supplied with double air reservoirs.

"I assume that the experience of men actually at work, and who have daily opportunities for witnessing the operation of the automatic air brake and its working, would be much better evidence as to the reliability of the brakes, and the necessity or otherwise for maintaining an additional staff of brakemen, than any theories or opinions that might be elaborated from an office, or by those who do not have the daily opportunities of observation and experience.

"For my own part, and based upon a close observation of the reliability of the performance of the automatic air brake, I do not believe that there is any necessity for maintaining a staff of brakemen to apply the brakes in time of need; nor do I think they would be of benefit. That service which men are called upon to perform in times of emergency only, and when such an emergency only arises after months of smooth and continuous working, soon becomes inefficient. A rigid drill, and holding up to close attention at all times, the service they are expected to perform in an emergency, would be the only manner in which brakemen could be made at all efficient when their services were really required, and so long as we have the frailties and uncertainties of human nature to contend with, and so long as it is almost impossible to devise any means for maintaining such drill upon passenger train brakemen, it must follow that at the moment when they are really needed, they would either not be at their posts, or more interested in seeing what was ahead and in taking care of themselves, than in applying the brakes with a view of stopping the train. The only possible opportunity remaining for establishing and maintaining such drill as to in any manner render effective in times of emergency such a corps of brakemen as suggested, would be either at regular or irregular intervals to cut out the air, and depend entirely upon hand brakes to stop the train. To my mind such a course would be fraught with and calculated to produce precisely the dangers sought to be avoided.

"It seems to me that the occasion that would most likely call for the use of brakemen, would be caused by the total failure of the air pump. Wherever we have such a case, and they are very rare, we invariably have a delayed train along the terminal point. Engineers accustomed to the use of the automatic air brake, will not in my experience make schedule time, but invariably lose, being unable to make stops within the accustomed distances. It would be much cheaper to supply every freight engine on the road with the automatic air brake, so as to be enabled to readily change engines in case of the failure of the brakes on passenger engines upon the regular run and the failure to make time, rather than to maintain the extra force of brakemen required.

"I have noticed of late in the press many instances of railroad accidents, closing with the remark that they were caused by the 'failure of the air brake.' Undoubtedly there have been cases of this kind, but the failures referred to are more frequently the failures of the engineer to apply the brake within a reasonable distance, of not to be expected that a train of six or eight Pullman cars, scheduled at forty miles an hour, can be stopped by the application of any brake within two or three car lengths, and yet I have seen engineers approach a block station where they expected to get a clear block, and to go on without stopping, not receiving the clear signal, apply the brake and run a considerable distance by the block station and then reverse and back up. Had an accident occurred at such a time, the excuse would have been the 'failure of the air brake to work.' The failures that I have observed are much the result of the same difficulty that was embodied in a conductor's report of delay in arriving at a terminal point, 'Failed to make time account hind car being too far from the engine.' The failure of the automatic air brake is the failure to apply it within the distance that a stop could properly have been expected to be made.

"I fully concur in the conclusions expressed in your letter—that the failures of the brake are of a character that should give ample warning to men of ordinary care and intelligence, and thus render as inefficient as it is impracticable the maintenance of a staff of brakemen as suggested."

The Wason Manufacturing Co. is building eight parlor cars for the state roads of Chili. These cars are different from ordinary coaches in the decorations and in the windows, which are each 4 ft. wide. The exterior of the cars is creamy white, finished with designs in blue, red and gold. Everything about them is bright and gaudy, for the South American loves high coloring and polish. Between each window is a match safe, for every one in Chili smokes. Four of the cars will be shipped during September, and in a few months dark-haired beauties will be resting in the reclining chairs, with eyes half closed, lazily blowing cigarette smoke through the windows as they are whirled along. Each of the cars will cost $12,000.

Communications.

The "Strong" Locomotive.

239 BROADWAY, NEW YORK, Oct. 12, 1887.

Editors National Car and Locomotive Builder:

I have read your remarks upon the tests of the Strong locomotive, and must ask leave to differ from you in several respects. First in regard to the question of the capability of the ordinary locomotive to meet the demands made upon it. I can not agree that conditions have been fulfilled when called for. The maximum running speed in England and America is just about 53 miles per hour, and this only to short runs, viz.: Baltimore to Washington, 40 miles in 45 minutes = 53.33 miles per hour; Manchester to Liverpool, 36 miles (by the C. L. C.) in 40 minutes = 54 miles per hour. In shorter runs we have Manchester to Warrington, 17¼ miles in 20 minutes, or 52½ miles including stoppages. In longer runs we have New York to Albany, 143 miles, in 3.30, or 40.9 miles per hour, and the Philadelphia fast runs stated to be at the rate of 45 miles. In England the fastest long time is probably Manchester to London (per G. N. & M. S. & L.), 205 miles in 4½ hours = 49⅓ miles per hour, with a climb of 1,000 feet at the summit level. The above runs are probably the fastest in England of their lengths and are curiously omitted by Mr. Dorsey in his celebrated paper, from which I obtain the American speeds here given. Though speeds of 70 or 80 miles are doubtless attained in places, the average running nowhere comes up to 60 miles, here or in England, and this is simply due to the incapacity of the locomotive to do the work desired of it, and the above fast runs are made with comparatively short trains, and are evidence that an all round speed of 60 cannot be maintained by ordinary locomotives.

There are two main reasons for this. The first is the imperfection of the valve gears, which at high speeds and reasorably early cut-off give so great a comparison curve that the mean effective pressure is much reduced thereby, and the traction of the engine brought too low to overcome the resistance. The second cause is the fact that the locomotive boiler is unable to supply sufficient steam to keep the engine going at so late a cut-off as would much reduce the compression curve; and further, by cutting off late at high speeds the exhaust is overpushed and a fault introduced which balances the reduced compression. The fault of the link motion is largely in the single valve. With a valve of this type it is impossible to regulate the steam distribution as one would wish, and yet at the same time do the same for the exhaust.

The "Strong" valve is quadruple, and in this fact lies the possibility of securing such diagrams as are appended to Mr. Leavitt's first report. Now no link motion single valve gear could possibly obtain at a piston speed of 1,300 feet per minute any such perfect compression as these diagrams show. You speak of their great back pressure. Granting this for the argument (though as a fact the back pressure was due not to the valves, but to the nozzle which was set to cut the fires, which were of poor, clinkering coal) only strengthens my opinion that the compression is a wonderful line, for, with so much residual steam in the cylinder, what sort of a curve would a link motion have given for this early cut-off? and right here comes in the question of clearance spaces. With independent exhaust valves the clearance may be reduced to the smallest possible minimum consistent with area of ports and passages, but it were useless to attempt to reduce clearance in an ordinary slide valve locomotive, for every reduction of the clearance only magnifies the evil of over-compression. On this point then the "Strong" gear shows its superiority. Next, as to the type of valve employed.

In "Wellington's" location of railways, it is stated that the slide valve moves $\frac{1}{16}$ as far as the engine when its travel is 5 inches and the area of the valve is say 20 inches by 10 = 200 square inches. The area of one Strong valve is say $[(20\times6) - 9\,(4\frac{1}{2}\times\frac{1}{2})] = 89$ square inches. The four valves have thus a total area of say 360 inches, or 1.8 times that of an ordinary slide valve, but they only travel $1\frac{1}{16}$ inches in place of 5 inches or $\frac{1}{16}$. The work of moving the "Strong" valves should therefore only be $\frac{1}{16}\frac{8}{0}$ths of 1.8 or less than $\frac{3}{10}$ths the work upon a common slide, and the "Strong" valve has the further advantage that being, as it were, divided up into sections, each section is moved at the most advantageous period, so avoiding the useless labor of dragging round the whole four sections when one only really needs to move, which is in effect what has to be done in an ordinary slide valve. At early cut off the Strong valve has a travel of only $\frac{1}{16}$ inch, the $1\frac{1}{16}$ inches mentioned above being of course the full gear travel. Then as regards the gridiron form. My experience in England as a steam expert was decidedly favorable to gridiron valves of short travel and I have always found them satisfactory, as notably in the Varley cut-off gear, which is so largely used in Lancashire for the high pressure cylinder of compound mill-driving engines. The Varley valve is simply a vertical moving grid and gives excellent indicator cards. The vertical hanging of the Strong valves too, insures that when working without steam on a down grade, they exert no pressure upon their seats just at the time too when cutting and grinding of faces and edges of ordinary valves from want of lubrication is so frequent.

The peculiar versed sine motion of the "Strong" gear by which only two valves are at maximum travel together, reduces the maximum eccentric pressure to a fifth of a link gear. Hence greater life of sheaves and straps. Whilst I do not admire radial gears when actuated from the main rod I can see no objection to such a gear as Strong's, in that there is not a single sliding working piece about it, only pin joints.

Then again, as to the water consumption shown by the cards. Whilst I consider a 20 per cent. addition for water, not shown by the card, to be excessive for so high a piston speed I am not disposed to accept that even 31½ pounds of water, as your figures would give it; per horse-power, could be for a moment regarded as a poor showing for a link motion gear at 1,800 horse power, but where is there a 20 inch × 24 inch link motion engine that ever approached such a power as this? Given a horse-power of 1,000, about the limit of locomotives till now, and the consequent lower terminal consistent with the earlier cut-off, and the water consumed would be so much less. Quite apart from the question of economy per indicated H. P. is that of commercial economic efficiency and that engine which will develop the greatest power per ton of its own weight, which bears the same relation to train load that does the weight of a car to its burden, is certainly deserving of being ranked as the most economical machine for it at 900 I. H. P. The traction of an engine and tender amounts to 50 per cent. of the total power developed; then when caused to draw double the train load the engine and tender traction will be little over 33 per cent., and any thing which will attain this economy of engine weight must have in it the elements of success, for at high speeds especially the adhesion of the locomotive has so far been much in excess of the steam power, and by so much has the locomotive been a badly balanced design. It is frequently urged in favor of locomotives that they do their work through so wide a range of power, speed, and circumstances generally; how much more then should the same praise be given to an engine whose record of power developed is 50 to 80 per cent. in excess of hitherto the best records.

Recurring to the form of boiler employed, I would draw attention to the fact that it is a near approach to what has been universally accepted as the best type of boiler in the greatest steam using center in the world, the Lancashire and Yorkshire districts of England. My experience there embraced a personal inspection of many thousand different boilers, and I must say that my experience leads me to expect nothing but good of the "Strong" form of boiler; now that the joints of the furnaces and combustion chamber are made with the Adamson flanged seam. Many score thousands of these seams are at work under every variety of condition throughout Britain, and their reputation is now beyond cavil. What better boiler then can be produced than one which is free from staying almost entirely, has no rivets directly exposed to fuel, and of a form which has established itself against all comers amongst the steam uses of a district where economy of fuel is especially studied and boiler work stands higher than anywhere else? The rectangular locomotive fire-box can never stand at higher pressures than now employed, with reasonable safety, because it is wrong in principle and so constructed as to tear itself in pieces by its own differential expansions.

While fully aware that numerous attempts have been made to improve the locomotive boiler, in order, as a chief end and aim, to produce a larger grate surface, I would point out that hitherto the designer has apparently sought merely to gain an extended grate, without reference to strength or other points of importance, the necessary resistance being merely gained by the brute force of numerous stud stays. Now the stud stay is of all stays the worst to connect two flat surfaces having a different expansion, as the thousands of breaking stays testify. There is not a stud stay at all in the "Strong" boiler. Will you point out where the boiler is weak in either design or principle? when I may have something further to say on the subject.

WILLIAM H. BOOTH,
Formerly of the Manchester Steam Users' Association.

Cylinder Condensation.

LONDON, Eng., Sept. 27, 1887.

Editors National Car and Locomotive Builder:

SIR: I observe in the current number of your excellent journal, page 116, an extract given by Mr. Angus Sinclair, from a paper of Mr. Isherwood's on cylinder condensation. This paper was published at length in the *Journal of the Franklin Institute* for October, 1885, and I embraced the opportunity of commenting on and replying to that part of the paper which is now reproduced in your columns in the same journal for December, 1885, page 454., etc. I also replied to it in the same terms in *The Engine* (London), for Oct. 16, 1885. I also now inclose a copy of my paper "On the Behavior of Steam in the Cylinders of Locomotives During Expansion," published in the Minutes of Proceedings of the Institution of Civil Engineers, England.* To this paper I presume Mr. Isherwood alludes when he states that "no one contested the discovery, or even used it, until quite lately." "This discovery," he says, "was made a great many years ago by him, and stated and used in his published professional writings." On the contrary, my experimental investigations on the behavior of steam in the cylinder, the results of which are summarized in the inclosed paper, were conducted in the year 1850, and the results were first published in the course of the year 1852,* or seven years before Mr. Isherwood even made or published any experiments bearing on the question. In the the inclosed paper I have briefly restated the evidence and arguments put forward and published by me in 1851-52, showing, among other things, the formidable losses by condensation and re-evaporation of steam in cylinders, and the augumentation of the loss, in proportion to the degree of expansion, and showing that without the adoption of special means for preventing or lessening condensation within the cylinder, expansive working by cutting off earlier than from one-half to one-third of the stroke could not be practiced with economy. Mr. Angus Sinclair, I see, makes reference to this deduction.

But Mr. Isherwood says: "No one contested the discovery or even used it until quite lately." I may say, for my part, that since the first publication of the result of my experiments and deductions, quantitatively as well as qualitatively, in 1851-52, I have repeatedly, in five different publications, announced the pregnant fact of alternate condensation and re-evaporation as a matter first demonstated and established by myself.† Besides, Mr. Isherwood appears to have forgotten his correspondence with Mr. G. A. Hirn, in 1879, respecting his (Mr. Isherwood's) claim advanced in the *Journal of the Franklin Institute* for July, 1878, to having published for the first time his "discovery." M. Dwelshauvers Dery published the correspondence in 1879,‡ from which it appears that Mr. Isherwood was anticipated by Mr. Hirn, by several years, in 1857; although, again, Mr. Hirn was anticipated by me in 1851-52. Mr. Isherwood is therefore in error in saying that "no one contested his discovery."

Allow me again to refer your readers to my replies in the *Journal of the Franklin Institute* and the *Engineer* for a full statement of the question. I may add that Mr. Isherwood has not published any rejoinder to my letter. So I suppose he agrees with me. D. K. CLARK.

* See Vol. LXXII. of the Minutes, Session 1882-83, page 275.

Railroad Machinery Notes from Cuba.

In the course of a private letter to one of the editors of this journal, Mr. F. F. Tynan, master mechanic of the Ferro Carril de la Bahia, Matanzas, Cuba, writes: "You ask me for notes of what I am doing here. I have for a number of years been greatly indebted to the reports of the Master Mechanics' Association for valuable information. We have one branch of our road where, owing to the very bad character of the feed-water, the life of a crown sheet is only about eighteen months. Heavy scale forms very soon. I use no boiler compound; but a few days before an engine is brought in to change flues or flue sheet, I put about four pounds of common coal tar in the boiler every day for about six days, the engine being kept on some light service so that she will not throw the water out of the stack. This loosens the scale so completely that no flue cleaner is needed to remove the scale, as it can be rubbed off with a piece of waste. This might be of some use to master mechanics on your Western roads.

"I am putting extension smoke-boxes and straight open stack on all engines as they come into the shop for repairs. I take great care to make the fronts air tight. I turn them up in the lathe and put in wire joints, and then try them with water before I let them go out of the shop. I have one running for nine months and she has not burned off the varnish yet, gives no trouble whatever and the engines go up the hills much better with the larger nozzle that can be used. The engines so equipped are much cleaner and more economical in every way. I am exactly of your opinion, that the extension smoke-box is the best thing that has been put on the locomotive in twenty years.

"I have used the brick arch, but do not think it pays for the trouble of renewing, or that it justifies running the risk of delays occasioned by its falling down on the road. Of course, it must be some advantage to have the mass of red hot brick inside the fire-box, but it is a very unhandy thing to have to crawl over every time anything has to be done to the flues, so I took them all out.

"We have got English, Scotch and French locomotives here, but we do not want to have any more of them. All we get now are American, for we have proved that it only costs about half the expense to repair American engines that it takes to repair those of European make, and the former do nearly double the service of the latter, besides being easier to handle and more convenient in every way."

* See *Railway Machinery*, 1851-56, Blackie & Son, pages 77 to 85. Also a paper "On the Expansive Working of Steam in Locomotive Engines" in the Proceedings of the Institution of Mechanical Engineers, 1852, pp. 63, 105.

† See the article "Steam Engine," contributed by me to the "Encyclopedia Britannica," eighth edition, published in or about the years 1856-57; "The Exhibited Machinery of 1862," page 300; "Steam and the Steam Engine" (Lockwood & Co.), 1875, page 267; "A Manual of Rules, Tables and Data for Mechanical Engineers," 1877, page 880; "A Rudimentary Treatise on the Locomotive Engine" (Lockwood & Co.), 1870, page 118.

‡ See *Revue Universelle des Mines*, 1879, Vol. V., page 494.

DROP-BOTTOM COAL CAR CONSTRUCTION.

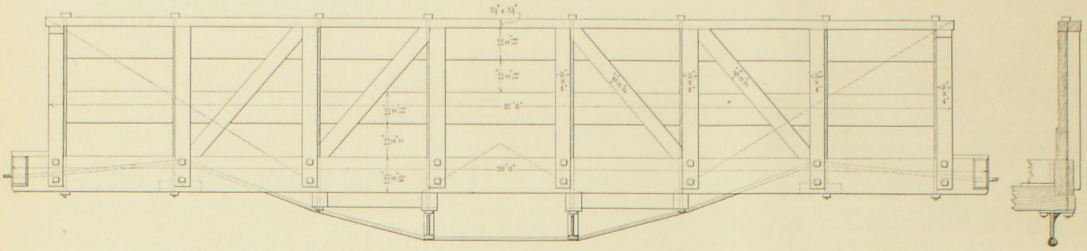


Fig. 1.

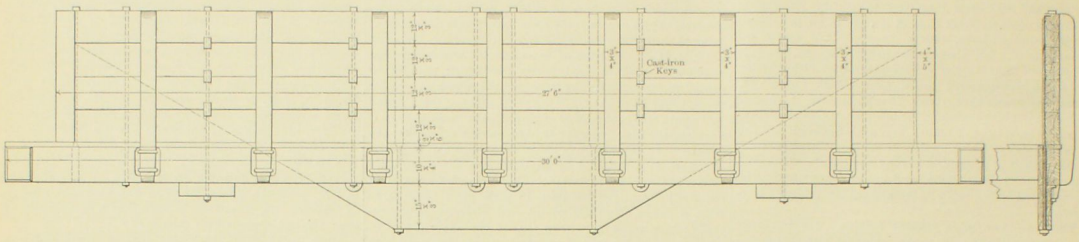


Fig. 2.

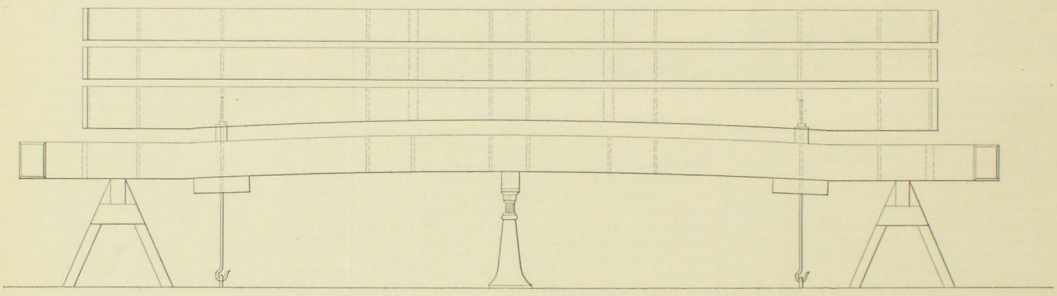


Fig. 3.

The accompanying engravings represent the sides of two standard drop bottom coal cars.

Fig. 1 is constructed after the plate and brace method. It consists of eight oak posts, 3 in. × 4 in. × 4 ft. 10 in.; four oak braces, 2 in. × 6 in. × 5 ft. 6 in.; one pine plank, 2 in. × 12 in. × 27 ft. 6 in.; three pine planks, 1¼ in. × 12 in. × 27 ft. 6 in.; an oak plate, 3½ in. × 5½ in. × 27 ft. 6 in., and the sill (pine), 4⅝ in. × 12½ in. × 30 ft. 0 in. The posts are halved out at the bottom to allow them to rest upon the sill, and are secured to sill by two ⅝-in. bolts, the tops being tenoned to receive the plate, which is secured by ten ⅝-in. rods, passing through plate and sill. The planks are secured to posts and braces by ⅛-in. bolts and ½-in. wire nails, the 2-in. plank at bottom. This seems to be a satisfactory method of constructing a coal car side, but constant usage has shown that it is not. The trouble is it swags under heavy loads. This car has lately been provided with a hog rod to obviate this trouble, it being placed close to the sill, as shown in cut, but this does not afford a satisfactory remedy, as it comes in serious contact with the dropping of the doors.

Fig. 2 is a very simple and inexpensive way of making a side which never swags unless being neglected in keeping the rods screwed up. The side simply consists of four pine planks, 3 in. × 12 in., a pine covering for sill 2 in. × 16 in., seven oak side posts 3 in. × 4 in., two corner posts 4 in. × 5. in. and the sill (pine) 4 in. × 10 in. These posts rest in cast-iron cuffs, which are secured to sill by two ⅝-in. U-bolts, the post being secured to planks by ⅛-in. bolts, and the whole side confined by eight ⅝-in. rods passing through planks and sill, two ⅝-in. strap bolts, secured to planks by ⅝-in. rivets on inside and passing through sill and hopperside and two strap bolts secured to sill by ⅝ in. bolts and passing through planks as shown in cut. The capacity of this car is 50,000 lbs., that of Fig. 1, 40,000 lbs.

Fig. 3 shows a way this car may be cambered after the frame is bolted together, a stick 4 in. by 8 in. extending from sill to sill is placed over the transom or there about, a kook rod connecting with an eye-bolt and ring, which is made fast to the floor, is passed through the 4 in. × 8 in. stick and screwed up to prevent this part of the car from moving up. A jack is placed under the center of another 4 in. × 8 in. stick, extending from sill to sill, under the center of the car. The jack is then screwed up until the desired camber is obtained. In this way of cambering a car, the ends from transoms out can be kept straight while between transoms are being cambered; any desired shape may be given to this camber by moving the kook rods and trestles. After the desired shape and amount of camber is obtained a template is made to fit the sill, it is then placed upon the first plank, and the bottom of it cut out, leaving the top straight.

The bottom plank of every coal car or gondola should be cut out at the bottom to suit the camber of the sill. It requires almost as much resistance from the hog rod to hold the side of a car in camber when the bottom plank is not cut to suit it as it does to carry the load. This accounts for the breaking of so many rods. Proper calculations are made as regards the size of the rod to withstand the load; but no consideration is paid to the enormous strain which is thrown upon the rod while bending the whole side of the car, or holding up the camber. The camber in cut is exaggerated to show more clearly its shape. The amount for a 30 ft. car should not exceed 1¼ in. nor be less than 1 in.

Brotherhood of Locomotive Engineers.

The annual convention of the Brotherhood of Locomotive Engineers was held in Chicago, beginning October 19. The meeting was opened with very impressive public service, in which interesting addresses were delivered by Grand Chief P. M. Arthur, Governor Oglesby, of Illinois; General Manager Jeffery, of the Illinois Central, and others. This organization has become very popular of late years with all employers of labor who are willing to give a fair equivalent for services rendered, and this feeling was strongly manifested in many ways during the time the Locomotive Engineers' Convention remained in session. The laws of the order are admirably framed to restrain the impulsive action of members suffering under real or supposed grievances, and they hold down all and sundry to the practice of Grand Chief Arthur's favorite precept, "let us reason together." When the men belonging to any road consider that they have just cause for the interference of the executive officers, they must use every endeavor to bring about a settlement, and if they can not succeed in this they may call the Grand Chief Engineer to their assistance. As Mr. Arthur is known to be zealously in favor of peace, the hot heads occasionally try to strike against railroad companies without his consent, but they always get the worst of it. The principles of the order are sobriety, truth, justice, morality, and the practice of the principles are as strongly enjoined upon the individual members as possible. The success and popularity of the order are doubtless due in a great measure to the ability and conservative character of its head officer, but the men show high average sense and wisdom in the strong support they give to their chief.

Western Railway Club.

The regular monthly meeting of this club was held on the afternoon of Oct. 19, at the Grand Pacific Hotel, President Rhodes in the chair. The first subject brought up for discussion was "What are the proper dimensions of an axle for a 60,000 pound car?" The discussion was opened by Mr. C. A. Schroyer, of the Chicago & Northwestern Railway Company. Mr. Schroyer said: It has been my experience in the construction and handling of freight car equipment, that it is always best to retain or keep as near certain well known points as possible in the construction of the car.

For instance, we have a standard track gauge and all our locomotives and cars have to be built to conform thereto.

We have a standard frog and a standard switch throw, a standard height of draft line and innumerable other standards, all of which and a great many more points have to be considered in laying out and constructing a car.

We have a defective side and end door attachment on our standard equipment, and we do not change them, because we know of none better that can be put on, without making a radical change from our present construction.

We have not changed on any new equipment, because it

leads to complication in all parts of the department where this material is handled. We use special attachments, special tools and special parts because they do not conflict with the general style or construction of the car.

We had at one time an axle 6 ft. 2¼ in. from center to center of journal, and 3¼ in. diameter and 6 in. length of journal, with dust-guard and collar of same sizes as used by the majority of roads at that time.

This axle met all the requirements, and performed all that was expected of it at that day.

Experience then taught us that we needed a car that would carry a heavier load, and the 3¼ in. × 7 in. journal axle was adopted as a standard, with a minimum diameter of 3 in. to journal and 6 ft. 3 in. from center to center of journal.

I think at the distance of 6 ft. 3 in. from center to center at the point where we should stop and go no farther.

The dimensions of an axle for a 60,000 capacity car, I would suggest should be 7 ft. ¼ in. over all, 6 ft. 11 in. inside of collars, 6 ft. 3 in. from center to center of journal, 4½ diameter by 8 in. length of journal, 5 in. diameter of dust guard by 2¼ in. length, and 5¼ diameter of wheel seat, 4¾ in. diameter in center of axle. The thickness of collar and the outside length will not need the consideration that the other parts require, and will start at the points of the center of the journals. From this point to the face of the wheel hub, we have sufficient space to construct an oil box, brass and wedge, and have enough space between the hub and box to allow for any lateral play of the wheels. As now constructed we have 6¼ in. from center of journal to face of wheel hub, and the oil box, constructed as the one proposed by the M. C. B. Association for the 8 in. journal, is 5¼ in. from center of bearing point to back of box. This would give us ⅛ in. lateral play.

I do not consider this enough; more space can be gained, however, by contracting the size of the inside and outside web of the dust guard space 1/16 in. each. And by contracting the dust guard space from ⅛ in. to ⅛ of an inch we could gain ¼ in. or ⅛ in. more.

We could also contract some on the face of the wheel hub if necessary with entire safety, and get spaces enough to construct a box for an 8-in. journal.

The point I wish to make in taking this of 6 ft. 3 in. from c to c, is that a journal for a 60,000 capacity car can be used on our standard truck, which has sufficient strength to carry the load, or as heavy a load over what they now carry as is needed, and no changes be made from the general construction of the truck.

The question of friction I take before I do that of strength, for I know that by taking an 8 in. journal and increasing the surface of the journal bearing sufficient to carry the same load per square inch, the diameter is increased so much that the strength is greater than is needed, but the friction under speed is increased so largely that I fear the journal will heat under speed more than it necessarily will be by the increased load carried.

On the journal we now use under a 40,000-pound capacity car we have a surface of about 82¼ square inches, 27½ square inches of which is covered by the brass bearing. The load it carries is equal to about 272½ pounds per square inch. To get equally as good friction results the weight of the increased load carried should be increased by the same percentage in bearing surface of the journal as on the load. This I find by taking an 8-in. journal would make 4 5/8 in. diameter. I consider this too large for the diameter, as the increase of friction under speed would be increased by so large a percentage that the journal would heat.

I have taken 4¼ as the diameter, because the friction under speed and weight is reduced to a minimum on what can be done where a journal 8 in. in length is used.

With a 4¼-in. journal we have about 103⅔ square inches of surface, about 34⅓ square inches of which is covered by the brass and 29½ pounds carried on each square inch of surface. This increases the friction under the load carried and decreases under speed from what it would be if the load was equalized as is now carried by the 40,000 pound capacity car journal. I know no rule to arrive at the proper diameter of this journal.

When we take 8 in. as the length whereby we could arrive at any better diameter than when we get by actual experience, and my impression and observation has been that a journal of this size will carry the load safely without heating under the speed now attained in our freight service, if proper care and proper oils are used in lubricating. As regards the strength of the journal at the outside edge of the wheel seat, we will have more than if we increased the distance from center to center of journal as recommended by the M. C. B. Association.

I have taken Nystrum's Mechanics as my authority, and find if we take 5½ as a factor of safety, that this axle made 6 ft. 3 in. from center to center of journal and 4¼ in. diameter at the back edge of dust guard, we have a carrying capacity of about 19,700 pounds each, or 157,600 pounds on the journals.

By increasing the distance from center to center of journal as recommended, it would decrease the carrying capacity of the axle to some considerable extent, and I do not know of any good reason why this distance should be increased and thereby lessen its carrying capacity.

The strength of 19,700 pounds to each journal I do not consider sufficient, and have therefore increased the diameter of the dust guard and wheel seat to 5 in. and 5¼ in. respectively.

If we take 4¼ in. diameter at the back edge of dust guard we will have an equalized carrying capacity with that at the back end of the journal, and under ordinary conditions this would be strong enough, for the weight of the load is transmitted through the brasses into the journal and from that into the wheel and from there into the track. But in case of moving over an uneven spot in the rail, or a frog, or a switch, or in case of derailment, the jar, or strain, or shake comes from the other direction; and I think the axle would be more liable to break at the back edge of the dust guard than at the journal if the sizes 4¼ in. are retained. The diameter at the center of the axle, I would say, should be 4¼ in., as we have strength enough at that point with this diameter.

These sizes are such as, in my opinion, are proper under a car of 60,000 pounds capacity.

I am in hopes my views will conflict somewhat with that of some of the balance of the members, and that they will give voice to their objections, as it is only by a free and full expression of opinions that new points are brought to light, and that will lead to the adoption of proper sizes for an axle under a 60,000-pound capacity car.

Mr. Verbryck, Chicago, Rock Island & Pacific, asked Mr. Scroyer to explain more fully his views on lateral play.

Mr. Schroyer explained that he was in favor of making the hub of the wheel check the lateral motion instead of the brass.

Mr. Verbryck said they had been constructing their boxes for years with only ¼ in. lateral play and found it a good plan. Considered that the journal should be 4½ in. thick for a 60,000 pound car. Did not favor in creasing the wheel seat over 5½ inches. Favored leaving the collar off the axle.

Mr. John Hickey (Milwaukee & West Shore) had to design ore cars to carry 60,000 pounds, and reached the conclusion that an axle with journal 4 × 8 in., wheel seat 5⅛ in. diameter, center of axle 4¼ in. diameter and total length of axle 2 in. more than M. C. B. standard was the proper thing to carry the car. Service had shown that axles of these dimensions give satisfaction. Did not think it practicable to make a satisfactory axle for a 60,000 pound car which could be used successively under a 50,000 pound, 40,000 pound and 30,000 pound car. Thought the iron got unreliable before it could endure the service represented by the repeated reductions in journal.

Mr. C. E. Smart (Michigan Central Railroad) favored large journals.

Mr. William Forsyth favored the figures proposed by Mr. Schroyer, but would prefer a collarless journal. The use of the collarless journal in passenger service has been proved the best we have, and in making changes we ought to take advantage of the best practice.

Mr. Verbryck favored a journal 4½ inches in preference to one 4¼ inches because it would last longer.

Mr. Schroyer: There are a good many points that enter into the question of friction that I must confess I was not able to make entirely clear to my own mind. The journal we now have under 40,000 pound cars has proved to be a good journal both as regards strength and friction. We have on that journal a circumference of 1 think 11 78 of an inch on each square inch of the brass bearings of the journal. We have a bearing of 272½ pounds. Now, if we increased the journal to 4¼ as Mr. Verbryck suggests, the circumference of that journal would be 12.57 square inches, with a weight on each square inch of brass of about 2-9 pounds. I think the difference between the circumference of those two journals enters into the amount of the friction, and there is where I think the trouble will come in. I have taken the 4¼ because I think I have reduced the friction there as much as it is possible to do, and still we claim enough wear to the journal, a half an inch, because I think that 3¾ is low enough to run the journal.

Mr. A. Forsyth did not want to see another axle adopted with a collar on. Showed a number of brasses taken out of boxes which strongly demonstrated the pernicious effect of the collar.

Mr. Sutherland, Chicago & Grand Trunk, said they were running cars very successfully with a collarless journal without any stop wedge. Use the M. C. B. brass and wedge cast in one.

Mr Hickey wanted figures to show in service the advantage of using a collarless journal.

Mr. Wm. Forsyth held that regular railroad service should be accepted as better than figures.

Mr. Schroyer mentioned that he favored a collarless journal, although the axle he recommended had a collar.

President Rhodes: There seems to be an endeavor to get more frictional bearing from the box and the hub of the wheel because they can not get it inside the box. Is it fully established that we cannot get it inside? Some little time ago we took up the matter of no flanges on steel-tired wheels, and we ran a car without any flange on the middle pair of wheels, on a sleeper, but we found after it got running awhile that it began to get hot boxes, on account of these cast iron surfaces coming together, and that temporarily stopped our experiments in that line and seemed to point out that we must provide for our end play somewhere else. We have been using the collarless axle on our passenger equipment for a number of years past with the most successful results, and we hardly know what it is to have a hot box under a passenger car.

LOCOMOTIVE SPRINGS AND EQUALIZERS.

In the absence of Mr. John Mackinzie, who was assigned to open this topic, Mr. A. Forsyth, of the C., B. & Q. R. R. Co., read the questions regarding springs and equalizers issued by the committee of the M. M. Association and his answers thereto.

Some remarks on the subject were made by Messrs. Hickey, Smart, Peck, of the Chicago Belt line; Wm. Swanston, Pittsburgh, Cincinnati & St. Louis; C. H. Foster, Chicago, Rock Island & Pacific, but no information of special interest was elicited.

REPORT OF COMMITTEE ON SAFE CAR HEATING.

Mr. William Forsyth read the following report:

After the close of the discussion on car heating at our meeting in March the following resolution was adopted:

"That it is the sense of the members of the Western Railway Club that it would be advisable for railway companies to investigate thoroughly and experiment with continuous steam heating for passenger cars, and that a committee of three be appointed to endeavor to secure the equipment of trains on the different Chicago roads with the various steam heating systems. While at that time the successful use of steam from the locomotive was doubted by many the sense of the meeting as thus expressed seems to have been sound, and the wisdom of the action is sustained by the fact that most of the prominent roads are now experimenting with this form of heating and some are so well satisfied that they have adopted it.

While your committee have not been very active in securing these results, the club may reasonably congratulate itself in having been influential in directing the current of opinion in the proper direction.

Public opinion and the action of some of the state legislators are so strongly opposed to the regular use of the car stove that the railway companies appreciate the importance of immediate experiment with continuous steam heating for the cars, and are actively and earnestly at work preparing for such tests this winter. The following is a summary of the continuous systems and the number of roads using them, as obtained from the last number of the *R. R. Gazette:*

The Martin system has been adopted by 4 roads and being tested on 11 other roads, The Boston & Albany have 35 engines and 119 cars equipped. New York Central have 22 engines, 130 cars equipped. The Emerson system is adopted by the Atchison, Topeka & Santa Fe, and is applied to the new equipment for their Chicago extension. The Sewell system, adopted by 1 road, is being tested by 11 roads. The Gold system is being tested by 10 roads. The Safety Heater Co., is being tested by 13 roads. Of the Chicago roads, the Illinois Central and the Chicago & Alton still pin their faith to the Baker heater. The Rock Island not yet decided. The Chicago & Northwestern will experiment with the Williams system. The Pennsylvania also. The Chicago, Burlington & Quincy also. The Milwaukee & St. Paul are experimenting with a method of their own. The Atchison, Topeka & Santa Fe with the Emerson.

The general introduction of continuous heating being secured, it is now important that some action be taken to make the systems interchangeable, or at least to obtain a standard coupling for the main steam pipes. This is needed to some extent among roads interchanging through coaches and sleepers, but to a much larger extent for the Pullman cars running regularly on any line. A Pullman car is now the foreign car which we have to interchange with, and some effort should be made to have a system of continuous steam heating with a standard steam coupling adopted for Pullman cars.

We therefore offer the following resolutions:

Whereas, The railroads of the country are rapidly introducing various systems of continuous steam heating for their passenger cars, each system having its own form of steam coupling and not interchangeable with the others.

Resolved, That a committee of three be appointed from this club to meet similar committees from the other railroad clubs and a representative of the Pullman car company, for the purpose of united effort in securing a standard coupling for steam heating on passenger cars.

Resolved, that the secretary be instructed to advise the other railroad clubs and the Pullman Company of this action, requesting them to name a date and place for a joint meeting of the committees.

WILLIAM FORSYTH,
J. N. BARR,
W. A. SCOTT, } Committee.

Remarks on the subject were made by Messrs. Swanson, Sinclair, W. A. Smith, and President Rhodes.

Mr. Schroyer was appointed to the committee in place of Mr. Scott, resigned.

New England Railroad Club.

CAR HEATING BY STEAM FROM LOCOMOTIVE.

The regular meeting of this club was held in Boston, Oct. 12.

President Lauder occupied the chair, and announced as the subject for discussion. "The Heating of Railroad Cars, and Legislation upon that Subject." He said this was a wide question; * * * he would like to see the question of legislation in railroad matters generally discussed, because it is a well-known fact that every legislature in Massachusetts is pretty apt to pass some railroad law, often as arbitrary and unreasonable as the present law in regard to heating.

Mr. Pennycuick exhibited a coupling for steam pipe between cars, and said of it: This coupler is wholly new, being entirely automatic. We take very little steam from the engine; nothing in comparison with what other systems require.

The President: You can not get something out of nothing. Now, to heat 10 or 12 cars from the locomotive, you have got to take a certain amount of heat to do it, whether you use steam or water. I can not see any great advantage in heating by hot water over steam, in an economic point of view. You have got to use so much heat either way to produce the result. * * * We are putting the Johnson heater into our cars.

Mr. Shinn: When the idea of heating by steam from the locomotive became prominent, in consideration of the fact that there are 7,000 heaters in use, I endeavored to utilize the existing apparatus. The plan that I adopted was that of injecting live steam into the water circulation. The steam was conveyed under the car by a single pipe, a reducing valve being used and a branch pipe taking the steam at about the center of the car. In a car fitted with the ordinary Baker system, with the temperature at 16 degrees outside, the car doors open and a violent wind blowing through, the water could, with 40 lbs. steam pressure, be heated to 212 degrees in about eight minutes, and this could be maintained with about 5 lbs. pressure. I have had one car fitted for experimental purposes. The experiment tried at 16 degrees was in February last, in the shops, not on a train, but with the same amount of pipe and under the same conditions as if it were. The hot water can also be utilized for supplying the wash basins in the car. The device is patented, and is in possession of the New York City Car Heating and Lighting Co., who will probably apply it before long.

The President: In this matter of the capacity of the locomotive to heat trains, I suppose it will be admitted that the heating of the train from the locomotive will decrease its power under certain circumstances. For instance, if the engine is exerting itself to its full capacity to draw the train—and that capacity is its capacity to make steam—it certainly can not pull that train and heat the cars. Fortunately most trains are lighter in winter than in summer, and there is a surplus of power that can be made available for heating the cars. But as a rule our engines have but little surplus. Now we have discussed this question pretty thoroughly; the other part of the question is that of legislation.

Mr. Lauder then read the Massachusetts law on car heating, and referred also to the New York and New Hampshire laws. He added: I will leave the discussion to others. Any railroad running a private car with a cooking stove in it is subject to a fine of $500. The President of the Old Colony asked me for my definition of a "common stove." My definition is, any stove that depends for its action on the radiation of heat from its own surface. I suppose the object of the Legislature was to provide safeguards against fire.

Mr. Adams: It seems to me there is enough steam wasted at the whistle and safety-valve to warm the train. We don't blow our whistles more than a third as much as we did three or four years ago, and I think we might do away with the other third. Mr. Coghlan wants to find out just how much steam is used in heating. Now, I understand that this can be scientifically determined, but I am not a scientific man, and I get my ideas from practical observation. If we can not tell the difference in the amount of fuel used in hauling seven cars between here and Springfield, and the engineer and fireman can not see that there has any steam been lost in the heating of the cars, we don't lose a great deal. It may be necessary to go into this question scientifically and measure the amount of steam used very carefully, but if there is no apparent difference in the amount used now from

what there was before the cars were so heated, I don't think it a matter of great moment. I don't hear that our engineers take any more coal than before. If we could perceive that we lost a ton or two of coal a day it would be worth while to consider the matter. If the engineers had to handle a good deal more coal for this purpose it would be for their interest to find fault with it, but they don't; they all like it and think it is the best thing they ever had. The passengers invariably say it is the best heat we have ever had in the cars. There is some little drawback to every thing. We were pretty well satisfied with the Baker and Johnson heaters, but they heat the cars too much in the spring and fall when we want but little heat. It is not so with steam from the engine, for in using it we can regulate the temperature and make it just right. On the coldest day of last winter, when the thermometer indicated 25° below zero at Framingham, I went there to see what the effect was on the temperature of the cars (heated from the engine) and found that the mercury stood at 72 in each car, and the ventilators were all open, as they had been all the way from Springfield.

I think the recent law is very unreasonable in its requirement—not giving the railroads any time, practically, to make changes in their modes of heating. The legislators might say, if asked the question why they did not allow us more time, "We gave you from June till October to make the change; why didn't you do it?" If any railroad had taken off its cars to put in steam-heating apparatus last summer, there would have been a terrible howl raised. I don't think there was a road that had a car to spare from its regular business. When business slackened a little they began to make the necessary changes, but there has been very little time. It is only two or three weeks since all the roads coming into Boston were taxed to their fullest extent to accommodate the excursion business. I think every road is now doing its best to comply with the law in the limited time allowed. The law will not allow us to make a fire in a stove, and we have 50 or 60 cars with nothing but stoves in them, and some other roads have more. Somebody will be cold, or else we shall have to render ourselves liable to a fine of $500, not only once, but every time we make a fire in a stove. It may be said that we should have been there when this matter was before the Legislature, and protested against it. But nobody knew about this; it was sprung on us as a trap. I asked a member of the Legislature about it, and he didn't know such a law had been passed until he heard about it in our office; so it is pretty evident the thing was rushed th ugh in a hurry. It is a very unfair piece of legislation, r?

The President: Our friends of the old Master Car-Builders' Club, in New York, have reorganized their club, and renamed it. It is now the New York Railroad Club. They meet at the old place, 113 Liberty street, and the next meeting will be held on the 20th of this month, the subject for discussion being "Car Heating." Some of the members of this club ought to go there and meet with them occasionally. We frequently have one or more members of that club here with us, and we should return the compliment.

While State laws are all right there should be some national legislation to cover this matter. I am not a constitutional lawyer, but common sense would indicate that laws passed like the State car coupling law and these State car heating laws, where cars are used in interstate service, are clearly unconstitutional and of no earthly force whatever. I can conceive of New Hampshire passing a law on this subject that would exclude Massachusetts cars from that State, and of Massachusetts passing a law which would exclude New Hampshire cars. The acts we have just heard read are different in many ways; perhaps it would be impossible to construct a car that would comply with all of them. If the general government would pass some law applicable to all the railroads in the country, we should then know what to do.

Mr. Adams: It seems as if these legislative bodies were laboring under the impression that railroad companies will not do anything except what they are obliged to, nothing for the good of humanity but what they are forced to. I don't believe that; I believe railroad companies look out for their interests the same as other people do. It is not for their interest to have in use anything that will render them liable to damage. All practical men know the difficulties in making any important change. Our company moved in the heating question before there was any movement on the part of the legislatures; and we did this because we thought it was both more economical and more safe.

On motion of Mr. Richards, it was voted that the subject for discussion at the next meeting be, "Material for Axles, Journal Bearings and Lubrication."

American Railway Master Mechanics' Association.

Circulars of Inquiry.

EXTENSION SMOKE-BOXES AND BRICK AND OTHER FIRE-BOX ARCHES.

To the American Railway Master Mechanics' Association:

GENTLEMEN: It is a recognized fact that the railway interest of this country is passing through a crisis unequaled in its history, and it is plain that it becomes the duty of all interested to aid in its safe passage. The fuel consumed by locomotives together with expense of adjusting fire claims, caused by fire thrown from locomotive stacks, are two of the largest items of expense connected with railway operations.

"Extension smoke-boxes and brick and other fire-box arches" is a subject bearing directly on the above points, and it is asked as a duty of each and every member of the association and of all having charge of railway machinery, to as ist the committee in getting out an intelligent and reliable report by answering as clearly and fully as possible the following questions:

1. What kind of fuel is used on your locomotives, hard coal, soft coal or wood?
2. What is the average amount of water evaporated per pound of the coal you are using?
3. What is your average cost per locomotive mile for fuel?
4. What form of smoke-box is used on your locomotives?
5. Have you had any experience with the so-called "Extension Fronts?" If so, please give dimensions of the same with sketch showing location and kind of netting, and situation of deflector plate if any used, also situation of exhaust nozzles and arrangement for discharging sparks.
6. What form of smoke-stack do you use in connection with the extended front? In the same connection please state size of engine cylinders, size of nozzles, dimension of fire-box and number of flues.
7. Do you advocate the use of single nozzle in connection with the extended front?
8. Have you had any experience with a device in the ordinary box that would accomplish the same end as that claimed for the extended front? If so, please state results obtained and send drawings of the same, and state if in connection any extras are used in fire-box as well as showing smoke-stack construction.
9. Do you favor the use of a draft or petticoat pipe in connection with the extended front?
10. What is the amount of additional weight caused by extended front and attachments?
11. How do you regard the old style smoke-box and diamond stack in economy of maintenance, economy of fuel and as a preventive of fires as compared with the extension fronts and attachments?
12. Have you used a fire-brick arch or other device in fire-box in connection with extended front? If so, please give dimensions of same, with sketch showing the device and manner of sustaining it, and the results obtained as compared with the plain fire-box in the same connection.
13. Do you favor the use of a brick or other arch in the fire-box of a locomotive using bituminous coal, and can you say from experience that the advantage gained thereby will warrant the expense of maintaining such arch.
14. Have you noticed any injuries to fire-box sheets resulting from the use of a fire-box arch? Please send drawing of the fire-box grates used in connection with your extended front.
15. Under what circumstances, if any, do you advocate the use of hollow stay bolts in fire-box for the purpose of admitting air above the fire?
16. All things considered, do you favor extended fronts on locomotives as now generally constructed? If not, please state objections.

Please do not confine yourself to the questions asked, but with your advice and aid of drawings give the committee any information you may possess bearing on the subject.

JOHN HICKEY,
W. A. FOSTER,
E. L. WEISGERBER,
Committee.

Replies should be sent to John Hickey, master mechanic M. L. S. & W. Ry., Kaukauna, Wis.

TRACTION INCREASERS IN CONNECTION WITH OVER-CYLINDERED ENGINES.

1. Can the defect of an over-cylindered engine be best remedied
(*a*) By the application of a traction increaser; or
(*b*) Would you in preference recommend that the cylinders be lined with a steel bush (a practice common in marine service); or
(*c*) That additional dead weight be judiciously distributed over all driving wheels; or
(*d*) That a lower boiler pressure be used with an altered ratio of steam expansion?
2. If you approve of use of traction increasers on the standard American engine, would you also recommend their application to Mogul, Consolidation and Decapod engines? If not, why would you restrict their application to four-wheel coupled engines?
3. Having equipped an engine with traction increaser would you dispense with sand and sand box?
4. (*a*) In your opinion does a traction increaser practically lengthen the engine wheel base, thereby increasing the locomotive resistance on curves?
(*b*) Can you quote an experiment showing the difference in haulage capacity of an engine so equipped—first on tangent and then on curve?
(*c*) If you have an engine equipped, will you try this experiment, and communicate the results?
5. If traction increasers are of acknowledged use in case of emergency, is there any reason why they should not be used continuously, and thus utilize each trip the advantage of the increased haulage capacity (this being the service for which patentees claim that traction increasers were designed)?
6. If they are useful at low speeds, is there any reason why they can not be made just as useful at high speeds?
7. (*a*) Are you familiar with any schemes for increasing traction other than those known as Dees, Purves, Craven (automatic traction draw car), and the Locomotive Improvement Company's?
(*b*) Would not the simple application of screw and lever (as used in European practice to increase the weight on a single driving axle) accomplish the desired end as effectively as the above-mentioned designs?
8. Have engines, regularly using traction increaser, developed any special failures in springs, spring gear, side rods, cylinders, loose tire or special wear on tires, or in cracks in frame, horns and horn stays?
9. Give any information possible as to first cost, cost of application and cost of repairs to traction increaser, also additional outlay or estimated saving in the cost of general repairs of engines fitted with the traction increaser?

This committee would like to have their report in the hands of the executive committee not later than the last day of April, 1888.

J. DAVIS BARNETT,
F. L. WANKLYN,
T. J. HATSWELL,
Committee.

Replies to be addressed to J. Davis Barnett, mechanical superintendent Grand Trunk Railway, Port Hope, Ont.

A Sleeping Car Incident.

Our friend La Rue, who is an old traveler, was recently journeying from Chicago to Detroit, and he kindly undertook to look after three children, aged seven, nine and eleven respectively, who were going to visit their relatives. The children were in the next berth to La Rue, and he took care to see that they were permitted to retire in good season. They did not feel like going to sleep, however, as all good children ought to do, at an early hour, but lay chattering a good part of the night. In the morning Mr. La Rue said to the eldest: "It appeared to me, Johnny, that you children did not sleep very well, for I heard you talking a great part of the night." A gruff old gentleman who slept across the aisle grunted out: "I should think they did not sleep any; they kept the whole car awake by their jawing." On hearing this, Mr. La Rue felt called upon to administer a severe rebuke to Johnny, saying that a boy of his age ought to know better than permit the others to make themselves troublesome by the noise they made when every one else wanted to be asleep. "Well," said Johnny, "I am sorry if we disturbed anybody; but you snored so loud all night that we did not think any one could hear our talk." Mr. La Rue closed the rebuke at this point.

A curious accident happened to a large bridge on the extension of a railroad in India which caused great delay in the opening of the road. When the bridge was almost ready for crossing the staging that supported an unfinished span took fire and the heat was so great that the main girders buckled and fell into the river. They were so badly damaged as to be entirely useless and the work was delayed while the contractors sent to England for new girders.

Westinghouse Air Brake Tests.

The perfected air brake for freight trains which the Westinghouse Air Brake Company produced to meet the requirements made apparent by the various tests at Burlington, has been applied to the company's train of 50 freight cars, and the owners are exhibiting its stopping powers in various leading cities and railroad centers. As now applied to the trains the brake is a marvel of simplicity, and the rapidity of its action is all that could be desired. The difficulty long experienced of making the brake in the hind portion of the train apply almost simultaneously with the brakes nearest the engine or point of application, have been entirely overcome, for it now takes only two seconds for the brake on the last car of a fifty-car train to be applied.

A representative of the NATIONAL CAR AND LOCOMOTIVE BUILDER has been invited to accompany the train and witness the tests made in the various railroad centers. The train, which is the same that went through the tests at Burlington, is 1,900 feet long and weighs about 2,000,000 pounds. Tests of the train were made at St. Paul, Oct. 14, at Chicago, Oct. 21, and the succeeding scenes of tests will be Cincinnati, Cleveland, Buffalo, Boston, New York, Philadelphia, and other cities where railroad men may display a desire to see the experiments made.

The tests at Chicago were made on the Wisconsin Division of the Chicago & Northwestern Railway, the same road where the first tests of the old brake were made in the West in 1869.

A stopping post had been erected, and distance stakes. The track was nearly if not quite level, and all the conditions were favorable for a fair trial. The first tests on the programme were emergency stops when the train was running at a speed of 20 and 40 miles an hour, with the following result:

Speed, 22 miles an hour; distance, 184 feet.
Speed, 37 miles an hour; distance, 487 feet.

These remarkable stops drew out cheers from the brotherhood engineers present. The leverages employed were low and there was no skidding of the wheels and no shock in the rear cars.

The third test was as follows:

Applying brakes while train is standing still, to show quickness of application and release.

The train will be placed so that the 35th car will be at the stopping post, and the operation of the brakes can best be observed at this point. When train is in position, two blasts of the whistle will give notice to be ready, and one blast a minute later will be given when the brakes are applied. After a short interval, another blast will be given, at which time the brake will be released by the engineer.

The brakes went on (to use the general expression) like a shot from a gun. As nearly as it could be timed, the release took place and the brakes were off on the 35th car in 25 seconds from the signal. The prompt action of the brakes was considered by all present as almost marvelous.

The fourth test was an emergency stop with passengers aboard the train; speed, 20 miles. Fifth test, the same, except that the speed was to be 40 miles an hour. The result was as follows:

Speed, 20 miles an hour; distance, 164 feet.
Speed, 40 miles an hour; distance, 469 feet.

The absence of shock was the special point noticed in these stops, which were certainly amply satisfactory.

In the sixth test, which was a service stop, the train was stopped in 600 feet.

No. 7, a breakaway test, came next. The train came to a sudden stop when the uncoupling took place, the distance between the two parts of the train being only 59 feet, or about one and a half car lengths.

Two tests were then made with a train of 20 cars, intended to about equal the ordinary passenger train. The braking power was increased by changing the leverages; sand was used, and the quickest possible stops made without regard to sliding the wheels.

At 20 miles an hour the train was stopped in 120 feet.

At 33 miles the stop was made in 272.

It should have been stated above that before the 50-car train was divided a hand-brake test was made with it with four brakemen and one conductor, all in position, ready to apply the brakes, and the train running at 19 miles an hour; the stop was made in 1,200 feet. This was considered by all present an excellent hand-brake test, much better than is realized in actual practice. By comparing this with the fourth test, when the same train was stopped in 164 feet, the immense advantage of power brakes may be seen.

The programme of the tests contained the following interesting announcement:

Attention is directed to the kind of brake-beam used on these cars. It stands a pull of 25,000 pounds with less than one-quarter inch deflection. Companies purchasing the brake acquire the right to use this beam without royalty.

A large concourse of railroad men were present, including 350 delegates to the Locomotive Engineers' Convention, and many prominent railroad managers. Great admiration for the perfect action of the brake was expressed on all sides, and the earnest hopes were uttered that railroad companies would display promptitude in equipping their freight cars with such a powerful means for the prevention of accidents.

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JAMES GILLET, ANGUS SINCLAIR, } Editors.

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

The Discovery of Cylinder Condensation.

The letter published in another column from the celebrated engineer and author, Mr. D. Kinnear Clark, on cylinder condensation, wherein attention is directed to the fact that the writer was the first investigator of steam phenomena to discover the extent and influence of cylinder condensation and re-evaporation on the economical operation of the steam engine, will be accepted by all readers familiar with the history of steam engineering as a fair and correct statement of facts. We published the statement of Chief Engineer Isherwood, to which Mr. Clark takes exception, because it contained a clear and striking description of the behavior of steam in cylinders exposed to chilling influences, not that we indorsed the claims advanced by the writer as to being the first to discover and to direct public attention to the phenomena described. The experiments made by Mr. Isherwood have the very highest scientific value, and their importance has been fully recognized by the scientific world. The accounts frequently published of the results of these carefully conducted investigations have undoubtedly done much to make engineers familiar with the various manifestations of cylinder condensation, and they have done good by directing popular attention to a grievous source of heat waste; but we have not believed that the claims advanced by Mr. Isherwood that he first discovered the existence of condensation by the interaction of the metal of the cylinder would bear close investigation.

From the solicitude which James Watt displayed at various times to obtain cylinders of non-conducting material, we are under the impression that he was aware that more condensation took place in the cylinder than what was due to the abstraction of heat of the steam converted into work. In the paper on "The Behavior of Steam in the Cylinders of Locomotives during Expansion," referred to by Mr. Clark, he mentions that in 1843 Mr. Combes, a French writer, expressed the opinion that a portion of the steam admitted into the cylinder was immediately condensed by the less hot metallic surface. In 1846, Mr. Thomas Craddock in his "Chemistry of the Steam Engine," speaks of the presence of water in the cylinder and attributes it to the interaction of the metal. Dr. Pole, in 1848, in a treatise on the "Cornish Pumping Engine," expressed his belief not only in cylinder condensation, but adds that the moisture would be re-evaporated as the steam expands. These, however, were mere theories, but in 1851 Mr. D. K. Clark, in making investigations of the behavior of the steam in locomotive cylinders, discovered by application of the indicator that the expansion curves of engines with inside cylinders fell much more rapidly than those of outside cylinders with steam of the same initial pressure. Reasoning that the inside cylinder must be heated to some extent by the gases of combustion, and that, therefore, the cylinder must be more efficient than an outside cylinder although it looked the reverse, the investigator conceived the impression that the superiority of the outside cylinder was apparent rather than real, and that the comparative fullness of the diagram towards the end of the expansion curve was due to re-evaporation by heat previously absorbed by the cylinder. With this clue to work on the investigations were continued and discoveries were made which plainly indicated the effect of condensation at the begining of the stroke and re-evaporation towards the end. The discoveries were published in 1851 and 1852, so that there is really no question between Clark and Isherwood as to the priority of discovery for the latter began his investigation only about 1859.

The whole series of investigations made by Mr. Clark on the steam engine, and especially with locomotives, have been remarkably valuable. The experiments made with the small engines, in use on British railways nearly forty years ago supplied data which have held good in the design and management of the locomotive the whole world over ever since. Master mechanics who have closely followed the rules and proportions laid down by Clark as the deductions of his experiments, have always produced economical machines. In nearly every instance where radical departures have been made from the rules referred to, expensive and humilating mistakes have been committed.

Cost of Building Locomotives in Canada.

The article in another column by Mr. Francis R. F. Brown, mechanical superintendent of the Canadian Pacific Railway, on "Cost of Building Locomotives" gives detailed and valuable information on a subject which is of living interest to nearly all railroad men. The Canadian Pacific Railway has an excellent system of keeping the record of the cost of all work done, and the information given in Mr. Brown's article is of the most reliable character. The cost of work and material is very low, as viewed from an American stand-point, but both material and labor are cheaper in Canada than they are in the United States, and the system under which Mr. Brown gets his work done compares favorably with any system in operation for facilitating the production of work accurately and cheaply.

The paper by Mr. Brown on construction of Canadian locomotives, read last May at the meeting of the Institution of Mechanical Engineers, in London, which we have largely quoted, excited unusual interest, and the cost of the engines has been the subject of considerable controversy. British locomotive builders were unwilling to admit that locomotives could be built more cheaply in Canada than they could be made in the British shops that had much cheaper labor, cheaper material and had been in the business for half a century. Some American critics, on the other hand, taking the cost of locomotives built by the Pennsylvania Railroad Company as a basis of comparison, questioned the possibility of a Canadian shop producing good work at a cheaper rate. Yet it appears to be done. In all essential particulars the system of building locomotives followed by Mr. Brown is the same as that followed in all first-class railroad and contract shops in the United States. The work is produced on a manufacturing basis, with first-class tools and good workmen operating on the subdivision of labor plan and as far as practicable under contract. For some departments of work, Mr. Brown's figures agree very closely with the cost of work in certain American shops noted for economical production; but the run of his material, owing to the lighter tariff, is cheaper than that which has to be paid for by railroad companies in the United States, which tells on the total cost of the Canadian locomotives. Having recently enjoyed the opportunity of minutely examining the locomotives built by Mr. Brown, we willingly testify to the excellent work put upon them. They have received no superfluous finish, but the working parts are all well fitted and designed to produce a durable and serviceable engine. We are convinced that the real test, viz., that of hard service, will demonstrate that Mr. Brown has produced not only a very cheap locomotive, but one that will work satisfactorily and wear as well as anything built on the American continent.

Pride of Purely Practical Practices.

A mysterious case of loss of power happened some time ago to a locomotive on a railroad where the work of repairing was done in the good old fashioned way, where drawings were dispensed with and approaches at accuracy were conducted on the rule of thumb system that many of our railroad men still patronize with every sign of loving kindness. The locomotive was rebuilt, and when she went out of the shop, she proved almost worthless in service compared to what she was before going into the shop. She would neither pull nor run as she was known to do previously. All sorts of theories were advanced to account for the change. Valves, pistons and exhaust passages were in succession examined, and various changes effected with no improvement. After the various changes had failed to make the engine any better, the men in charge decided that it was one of those mysterious cases of incurable perversity that sometimes seizes machinery turned out of the best regulated shops, and that the only thing to do was to endure the change for the worse in the engine with as much fortitude as possible. Of course all trainmen got abusing the engine, and she soon became the Ishmael of the road. Owing to the hard feeling against her and her own general worthlessness, she was kept in the round-house when not absolutely forced out by pressure of business.

One day that the foreman was complaining about the worthlessness of the engine, a machinist in the shop said he could cure her, and he was readily given permission to try. He proceeded to remove the dome cover and took out the throttle valve. Then he substituted another of ordinary design and the engine was all right. The cause of the trouble with the engine was that the throttle valve did not admit steam properly. When the engine was undergoing the rebuilding, a new throttle valve was needed, and the pattern maker, an ordinary carpenter (the kind of mechanic where cheap labor always proves expensive), was directed to make one. He was an enterprising mechanic, and instead of connecting the ends of the valve with ribs as usual, which leaves space to admit steam, he made the whole thing solid with the view of giving it increased strength. It might appear curious to those not accustomed to the ways of rule of thumb shops that a valve made in this way should be cast, cleaned turned, fitted and ground in without some one detecting the mistake made, but those familiar with the ways of such shops will not be surprised that the engine was turned out with the valve in this condition.

The loss incurred by the railroad company by the inefficiency of this engine during several years of service must have amounted to thousands of dollars. Had an indicator been applied when it was found that the engine was not working satisfactorily, the location of the defect would have been made apparent immediately. Such glaring cases of incompetency as the officers in charge of this engine displayed, are fortunately not common; but it is far too common for first class roads to have locomotives that are not working satisfactorily, while there is no intelligent system adopted for finding the origin of the inefficiency. Examining pistons that are in perfect order, inspecting steam passages that are perfectly open, changing valves that are properly proportioned, altering the throw of eccentrics that harmonize with the scheme of the valve motion, are lines of work adopted amidst protracted delay and serious expense as the "practical" methods of searching for a defect. The plan is about as amusing to a disinterested observer as a game of blind man's buff, which it strikingly resembles, for it is pure groping in the dark; but when a man, with knowledge which gives him a clear perception of what is really wanted, proposes to apply an indicator to the engine, he is sneered at as a theorist. There are many of our theorists much more practical than the man who makes it his boast that he is purely practical, which generally means very little after all, as the work he can do with his hands is generally his whole capital, brain being an unknown and unnoticed quantity. If there were a little more inclination on the old fashioned railroads to use as methods of investigation the means which scientific training has produced, and less tendency to depreciate new and accurate methods, there would be reason for fewer complaints that master mechanics were degraded into mere engine-house foremen. When a man by his daily act, walk and conversation convinces all intelligent men that he is incompetent to move with the tide of progress, there is really little cause for complaint when all other officers naturally fall into the way of acting as his superior.

Mr. Booth on the "Strong" Locomotive.

In another column will be found a letter from Mr. William H. Booth, an able English engineer, now in the employ of the Strong Locomotive Company, taking exception to our estimate of the performance of the Strong locomotives published in the October number of the NATIONAL CAR AND LOCOMOTIVE BUILDER. In the first place, our correspondent questions the accuracy of our assertion that the master mechanics of America have provided locomotives which meet all demands made upon them. After giving particulars of the speed made by the fastest trains in this country and in England, he says that the average running speed comes nowhere up to 60 miles per hour, and this is simply due to the incapacity of the locomotive to do the work desired of it. We do not think that many railroad men will agree with the statement made. Railroad managers object to high speed trains because they are troublesome to handle and dangerous to the traffic, and travelers are not willing to pay a fair share of the extra expense entailed in running such trains. These are the real reasons why trains are not run at a speed of sixty miles an hour, not that there is any question about the capability of locomotives to take the trains over the road at the speed named. When the subject of running trains from New York to Chicago in eighteen hours was publicly discussed a few years ago, and special types of locomotives were proposed for the service, we asked most of the superintendents of motive power of the leading trunk lines between New York and Chicago what kind of engines they would provide if the call for such running arose, and each of them answered that he would be ready with the motive power when the call for the high speed arose, and that he would use an eight-wheel locomotive, with a specially large boiler.

We believe that most railroad men who have had to interest themselves in the mechanical problems involved in moving fast trains will agree with us in saying that Mr. Booth is mistaken when he asserts that speed of sixty

miles an hour cannot be maintained, owing to the imperfections of the common valve gear. Our impression, obtained from good opportunities of watching the performance of all sorts of high-speed locomotives, is that the power of a well designed link-motion engine in good condition is limited by the capacity of the boiler to supply steam and by that alone. The Strong valve gear undoubtedly has the effect of increasing the capacity of the cylinder by providing the means of maintaining a higher mean effective cylinder pressure than what is practicable with the link motion, but we fail to see where any saving of steam is effected, and we believe that the same result could be obtained in a link motion in a much simpler way by merely increasing the diameter of cylinder and thereby avoiding the complications of mechanism necessary to operate the Strong gear. The claim that a saving of power will be gained by this gear, owing to the limited distance the valves have to be moved, and to the good balance of valves may be well founded; but, on the other hand, there is a probability that when the working parts get worn the disturbance to the accurate distribution of steam will be proportionately greater than it is with valves of longer travel. We admit that the periods of release and valve closure can be regulated much better with the Strong gear than with the link motion; but we look in vain for any material advantages that accrue from the "improvement." The release is protracted to near the end of the stroke and then the valve opens suddenly to let the steam escape; but the exhaust nozzle intervenes to "gag" the escaping steam, and the back pressure is so great that the advantages of protracted release are lost. The exhaust valve is not closed till near the end of the return stroke, and compression begins so late that the piston is unobstructed, except by back pressure, till it nearly reaches the end of the cylinder which gives a gain in power. This advantage is, however, of doubtful utility, for with the badly exposed cylinders of a locomotive the tendency to condensation of steam is very great, and moderate compression undoubtedly performs valuable service in heating up the cylinder metal at the beginning of the stroke. Whether or not the Strong locomotive can economically dispense with this means of re-heating the cylinder is a question which work in real protracted service and accurate tests will be required to decide.

The assertion made that the engine which will develop the greatest power per ton of its own weight is certainly deserving of being ranked as the most economical machine is rank heresy of the doctrine of modern locomotive design as lately preached. The worst faults of American locomotive construction have certainly been due to the ambition of designers to develop the greatest possible power with the least possible weight. We have seen or heard nothing of the performance of the Strong locomotive to justify the assertion that her "record of power developed is 50 to 80 per cent. in excess of hitherto best records. The railroad world is hardly disposed to accept the testimony of fugitive runs badly recorded as establishing the capability of the engine beyond peradventure. There are good points raised by an officer interested in the reputation of the Northern Pacific locomotives, who writes us, objecting to the spirit in which the comparison is made between the performance of the Strong locomotive and that of those belonging to the Northern Pacific. He says the N. P. eight-wheel engine, with cylinders 18 × 24 inches, driving wheels 5 feet diameter, weight on same 60,500 pounds, with a boiler pressure of 135 pounds, hauls twelve cars up the grade mentioned. The Strong engine, with six driving wheels, 62 inches diameter coupled, cylinders 20 × 24 inches, 90,000 pounds weight on driving wheels and boiler pressure 175 pounds, hauls 14 cars up the same grade and the performance is declared praiseworthy. Let them think so.

While we are not disposed to find fault with the Strong boiler, we must take exception to Mr. Booth's remarks about the ordinary locomotive. He says that the rectangular fire-box can never stand at higher pressures than now employed, because it is wrong in principle and would tear itself to pieces by its own differential expansion. He has also some very hard things to say about the stud stay. The remarks on this subject remind us that a great many things about railroad machinery are evidently wrong in principle, yet with all their fundamental faults, they give surprising results in service, and are much safer and more durable than things which are made with greater regard to true principle. The rectangular fire-box is like its associate, the link motion—its faults are legion and every body is willing to expatiate upon them, but it performs the work required better than any thing that has yet been offered as a substitute. Fire-boxes of this form are standing pressure approaching two hundred pounds to the square inch, and they do not show alarming indications of tearing themselves to pieces by their own differential expansions. Until more signs of this source of destruction present themselves than have yet appeared, master mechanics will be apt to go on increasing their boiler pressure, and while abusing its short comings keep on using the fire-box.

We hope the corrugated furnace adopted in the Strong design may prove as successful with locomotives as it has in marine boilers; but it does not follow because it is an unquestionable success in the latter case that it must to a certainty be suitable for the former type of boilers. It is not long ago since corrugated side sheets were very extensively applied to locomotive fire-boxes, and the speakers who advocated this form of construction proved conclusively by the most rational argument and logical reasoning that the corrugated shape must be stronger than the plain sheet, and that it must be more durable because the bent form would permit the sheet to expand and contract without unduly straining any part, consequently there would be no trouble from the cracking which caused so much annoyance with steel sheets. It appears that this reasoning would apply pretty squarely to the corrugated tube furnace. When one of them makes steam for two years on a Western railroad, we will be able to judge whether or not it will be influenced by the elements of weakness which forced the corrugated fire-box out of use. Till then, it will be as well not to shout too loud for the corrugated furnace.

The Coupler Decision.

We print elsewhere the official announcement of the adoption of the Janney type of coupler as a standard by the Master Car-Builders' Association, the vote standing 474 in favor and 194 against, or a clear majority of 30 over the requisite two-thirds. After the prolonged agitation of the subject from year to year, and the enormous difficulties that had to be overcome, this decision can hardly fail to be satisfactory to the great majority of railroad men, although it is not expected to meet with unanimous approval. Had the vote been indecisive, another period of agitation, contention and profitless discussion would have followed, with no result but further procrastination and discouragement.

It would have been better had the total vote cast been larger and the minority vote smaller. But the decision as it stands is final so far as the Master Car-Builders' Association is concerned and the type of coupler adopted. There can be no appeal, reconsideration or arrest of judgment, no getting back on the ground that has already been gone over. The beginning of the end has apparently been reached, and it only remains for the association to go on and finish the work by harmonizing the several devices included in the type that has been adopted, so as to secure practical uniformity. That there will be no dilatory action in this respect, is evident in the promptness of the Executive Committee in appointing a sub-committee of five to critically examine the couplers belonging to the type, and report the result early in January next.

The other proposed standards submitted to letter-ballot failed to receive the necessary two-thirds majority and were not adopted, namely: a non-automatic draw gear; an axle, journal box, journal bearing and wedge for freight cars of 60,000 pounds capacity; and the sizes of lumber for freight car bodies.

A Building in New York for Railroad Men.

This structure, erected by Mr. Cornelius Vanderbilt for the entertainment, instruction and moral improvement of railroad men, is now completed, and was formally opened on the evening of Oct. 3 by appropriate exercises. Addresses were made by Mr. Vanderbilt and Mr. Chauncey M. Depew, setting forth the objects for which the building was constructed, the nature of the privileges conferred, and the rules to be prescribed for its control and management, all of which was received with hearty approbation by a large and enthusiastic audience. Beautiful as the exterior of the structure is, a glance at the interior, with its costly and luxurious appointments, furnishes more convincing evidence of the munificent liberality of its projector in behalf of railroad men than any words can convey. It is a building which speaks for itself, and we venture to say that the benefits to be derived from it by those connected with the roads using the Grand Central station will not be the limit of its usefulness. The influence of Mr. Vanderbilt's liberality in the erection of this truly palatial structure will lead to the erection of similar ones in other railroad centers.

The building, architecturally, is an ornament to a portion of the city where beautiful buildings are to be seen on every side. It is situated on the corner of Madison avenue and Forty-fifth street, near the Grand Central track yard. The basement is reddish sandstone. The superstructure consists of two stories and a third story in part, combined with a high-peaked tile-covered roof, the walls being a combination of buff and red brick with terra cotta trimmings. The interior throughout is a labyrinth of rooms admirably adapted in size and location to their respective uses. In the basement is a gymnasium, with bowling alley, shower and tub-baths, and a plunge bath 6 ft. deep, 9½ ft. wide and 13½ ft. long. The bath tubs are of porcelain, the water-closet fittings are of marble set in bronze castings, the ceiling of white tiles, and the walls of white glazed porcelain brick. On the main floor are the business offices, a reading room with files of daily, weekly and monthly papers, a library containing 6,000 volumes, a social room containing a piano, luxurious settees and tables for chess and other games. On the second floor is a lecture hall, furnished with single cane chairs for 400 persons. A portion of this room is designed to be used for classes in drawing, stenography, etc., and can be separated from the other portion when required by drop curtains. On the third floor are the janitor's rooms and kitchen, also beds for trainmen, each in a separate compartment.

A marked feature of the entire interior construction is the excellence of the material and workmanship—marble stairways, tiled floors and ceilings, polished oak and ash wood-work, and elaborate and tasteful ornamentation.

The building was constructed wholly at the expense of Mr. Cornelius Vanderbilt, who has placed it in the hands of a board of trustees consisting of Cornelius Vanderbilt, F. W. Vanderbilt, Chauncey M. Depew, Charles C. Clarke, George H. Watrous, J. Pierpont Morgan and John M. Toucey, all of whom are directors or officers of the roads using the Grand Central station; and the conduct and management of it will be under the direction of the Railroad Branch of the Young Men's Christian Association, which now has rooms in the basement of the passenger station.

A regular program of entertainments, lectures, receptions, educational classes, religious meetings, etc., has already been prepared, with the exception of some additional details which are not yet matured. We are indebted to the General Secretary, Mr. George A. Warburton, for courtesies extended to us during our visit to the building.

Pure Steel is Good Steel.

There is no metal, not even royal gold, which has so many romantic and mystic associations connected with it as steel. The necessities no less than the enmities of mankind made at all times the use of a trusty weapon of the first importance, and no material has ever been found so reliable for offense and defense as tried steel, be it in swords, spears, arrow heads, rifled guns or in vessel armor. Almost since the dawn of civilization there have been preserved romances of wonderful steel weapons, and the struggle among the early metal workers to excel in the fabrication of steel weapons, no doubt gave valuable impetus to the development of the metal workers' art, and efforts toward excellence that originally aimed to make death-dealing more certain, became indirectly the means of improving and perfecting tools and utensils of useful industry.

The most famous steel of ancient times was the wootz of India and Golconda. From the latter, the celebrated Damascus sword blades were made, that ancient city of Syria, which was the Sheffield of the Orient, having long been noted for the excellence of its cutlery, and particularly for the inimitable character of its swords. Modern blacksmiths appear never to have produced anything equal to the ancient Damascus blade in temper, tenacity and hardness. Many wonderful stories are told, illustrating the astonishing cutting power and strength of these weapons. Swords made in other regions in later years have become famous as triumphs of the blacksmith's art; but none of them have equaled the ancient product of Damascus. The makers of all fine weapons have pretended that the cause of the success of their art was a secret, a tendency which is common to all workers in metal. In all finely-developed skill there is a something secret which can not be given away, although the possessors are hardly aware of the fact; and it is doubtful if there ever was anything more mysterious about the production of cutting tools of rare excellence. The men who fabricated the ancient and modern weapons which have become famous, were perfected artists deserving to stand in the same rank with the greatest artists of any time, as their art was a creative poem, putting material into perfected forms. In one respect these great masters of steel working were noted for uniformity—they handled the very purest metal that could be made. The masterly manipulation of the metal in forging produced elaborate figures and beautiful designs, highly developed skill in tempering produced surprising flexibility, but tenacity, ductility and durability were due to purity of material.

The wootz steel of India was noted among all ancient cutlers for its freedom from foreign elements, but the Golconda steel was still nearer to being pure metal. It was made from wrought iron made from an ore of extraordinary purity, the iron matte being produced direct by fusing the ore with charcoal. The iron was cut up into small pieces and fused in crucibles that each contained about one pound of metal. Extraordinary precautions against certain supposed evil influences were followed in the fusing of the metal, and considerable mummery accompanied the operation; but all the operations were calculated to prevent the introduction of any foreign element.

Modern metallurgists have relinquished many of the mummeries and pretended mysteries of ancient steel makers, but those who are producing the steel that gives greatest satisfaction in modern art, appear to be as solicitous to secure pure material as were their ancient predecessors. The pruning hook and plow shear which have succeeded the ancient sword, do not call for a high quality of steel; but there are departments of modern art where it is just as important to have absolute purity, as it was in the making of fine swords and other death-dealing articles.

During a visit to Pittsburgh we enjoyed the pleasure of considerable intercourse with the noted metallurgist,

Dr. Otto Wuth, and knowing something of the quality of steel used in ancient cutlery, we were very much struck with the vigorous manner in which Dr. Wuth insisted on purity of material as a means of providing steel of a quality satisfactory to meet the requirements of modern industry. Tools, delicate springs and cutting instruments give demand for steel of the very finest quality, that being all refined crucible steel. But we find that a problem which has occupied the attention of metallurgists, and has severely tested the resources of science and developed skill, has been the production of mild steel of uniform quality which would stand the trying service in locomotive fire-boxes. The solution of this problem has for years occupied Dr. Wuth's attention; and the result of his labors and scientific researches is an open-hearth method of mild steel making, which is followed by Shoenberger & Co., Pittsburgh, with the most gratifying success. The process is not easily followed in all its details, but during a day spent in the steel works watching and noting each operation, we made out that the quality of the metal was so well controlled that the product was almost uniform for each purpose. The various operations have to be conducted with extreme care and consummate skill. At the beginning of the steel-making operation the ore is selected which is known to be particularly free from phosphorus and other troublesome impurities, and every subsequent manipulation is regulated and arranged to eliminate impurities.

Dr. Wuth holds that the steel which approaches the nearest to pure iron and carbon is the best for all purposes. It has been shown practically that in climates where the extremes of heat and cold are not great, that steel rails which were proved by analysis to have a greater amount of impurities present than others have given the longest service. This is apparently in conflict with the assertion that the purest is the best for all purposes, but it is an apparent rather than real exception which does not vitiate the rule. Hard rails, in a moderate climate, free from the trying conditions of very low temperature, naturally, from their hardness, wear longer than soft rails; but if the same degree of hardness had been induced by carbon, the rails would have worn still better and been more reliable; as the hardener, carbon does not induce crystallization which sooner or later develops when phosphorus and other impure hardeners are present to any great extent.

When steel is subjected as in a fire-box to sudden and great changes of temperature, the tendency to crystallize and crack is in direct proportion to the quantity of impurities present. If the steel had nothing in it but pure iron and carbon it might be heated and cooled almost indefinitely without changing its structure. Phosphorous is by all odds the greater enemy of steel, especially if the latter be subjected as in a fire-box to the extreme limits of temperature that accompany heating and cooling. Its vicious tendency is enhanced by heating and cooling, and it exercises a greater influence than all the other impurities together. Silicon if as low as .015 or .02, and manganese as low as .35, have apparently no influence for good or evil practically, sulphur is never present in good boiler steel. Surface finish, or great smoothness in boiler steel, is no criterion that its quality is good. In fact, if the manganese be almost entirely eleminated, pitting is sure to occur under the process of rolling. A pitted sheet, therefore, generally indicates pure steel. In the best fire-box steel analysis would be

Carbon	.10 to .12	Silicon	.015
Phosphorus	.010 to .015	Sulphur	None
Manganese	.30		

Such steel would last indefinitely in a locomotive fire box so far as cracking is concerned. Tank steel, as is known, if bent over cold and closed flat would crack half or clear through, while good boiler steel such as the above analysis shows, would bend like lead. The analysis of tank steel is, on an average:

Carbon	.10 to .12	Silicon	.015 to .030
Phosphorus	.10 to .12	Sulphur	.015 to .030
Manganese	.30 to .35		

It will be observed that the chief difference in the two analyses is, the tank steel contains much more phosphorus and sulphur while the balance of analysis is the same; and still the influence of phosphorus is so great to induce cracking that its excess alone in the tank steel causes it to crack cold if bent over and closed. If the phosphorus and sulphur were reduced in the tank steel to the boiler steel's proportions it would be the same thing. The effect of phosphorus is especially shown in fine tool steel. Steel fit for watch springs, etc., must not have more than .006 or .008 of phosphorus. When it reaches .012 or upward, it is valueless for this purpose. Tool steel used in machine shops has from .015 to .018 of phosphorus. As it approaches .020, its poor qualities are shown while with .025 it is useless for tool steel purposes. Carbon should not exceed .15 in boiler steel, because above that its presence is sufficient to cause the steel to take a temper if heated and suddenly cooled off. Tool steel tempers and becomes very hard because carbon is present in 1 to 1.25 per cent. Annealing boiler steel by the maker puts a false ductility into it. No good fire-box steel is annealed, but there is much annealed steel sold for fire-box purposes. The effect of the annealing soon disappears under the heating and cooling of a fire-box. Tank steel if annealed will show remarkably ductile qualities and will pass the U. S. marine boiler requirements frequently, which were until recently purely physical tests. The only true and sure test of boiler steel is the chemical analysis. If this shows right the steel may be depended on. But steel may show good physical tests and fail soon in the boiler, because its good physical qualities are due to annealing. The chemical analysis would detect this, the physical tests would not.

Protection for Watches.

At the invitation of Mr. C. K. Giles, the well-known watchmaker and expert, of Chicago, a representative of the NATIONAL CAR AND LOCOMOTIVE BUILDER recently witnessed a series of scientific tests to demonstrate the effect of magnetism upon the movement of watches, and the influence which the anti-magnetic shield has in neutralizing the magnetic force. Tests were made which showed the effect of strong magnetic force on watch movements, such as placing the watch close to powerful magnets, which was equivalent to placing it within the potent influence of the electricity diffused from powerful dynamos; and also the lighter but disturbing effect, due to the minute magnetism excited by a blow on an iron spike, which acts in a manner analogous to the distantly felt influence of dynamos and electrical conductors. It was shown that magnetism is almost universally diffused, and is particularly strong in the presence of certain surroundings, such as the presence of electrical generating machinery or conductors and near large bodies of iron and steel strong enough to disturb the action of a watch by retarding the movement of the balance wheel. By numerous experiments that were convincing to a strongly prejudiced observer, Mr. Giles demonstrated that the magnetic shield used prevented the balance wheel from being acted on by strong lines of magnetic force that might be surrounding it.

The theory of the shield is that a neutral center is formed in which the electrical currents meet or neutralize each other, and there the watch movement vibrates in a uniform medium. Where uncontrolled magnetic influence is present, the balance wheel vibrates in a mixed medium like what it would meet if a portion of the wheel had to cut through a drop of water or a vacuum, while the remaining part was in air. The shield makes a change similar to making the medium all air, all water or all vacuum. Our space will not permit us to give more particulars of what we saw, but we are convinced that the anti-magnetic shield is a valuable protection for watches.

The Standards of the Master Car-Builders' Association.

The following announcements are made by the Secretary of the Association, giving the results of the letter-ballots recently taken on the proposed standard automatic type of coupler, and other proposed standards that were sent to letter-ballot at the annual meeting of the Association in June last:

At the last convention of the Master Car-Builders' Association it was agreed to submit the following recommendations for decision by letter-ballot:

I. That the Janney type of coupler be recommended as a standard form of coupling.

II. That the "rigging" shown by Plate I. of the engraving herewith be the standard of the Association for non-automatic draw gear.

III. That the axle, journal box, journal-bearing and journal-bearing wedge, shown by Plates II., III., IV. and V., be the standards for those parts for freight cars of 60,000 lbs. capacity.

IV. That the following dimensions be the standard sizes for lumber for the principal members of car bodies:

For 34-foot box, stock and flat cars. Capacity, 40,000, 50,000 *and* 60,000 *lbs.*

Under Frame.

Six long sills, 5 × 9 in., finished Norway pine.
Two end sills, 7 × 9 in., finished oak.
Two cross-ties, 4 × 9 in., finished oak.
Four draw-timbers, 4½ × 7½ in., finished oak.
Flooring, 1¾ fn. thick, 5 to 10 in. wide, Norway pine.

Upper Frame.

(For the same cars as above, excepting flat cars.)
Eight door and corner posts, 4 × 4½ in., finished oak.
Twenty-four pieces intermediate posts and braces, 4 × 3 in., finished oak.
Two end plates, 3 × 12 in., finished oak.
Ten carlines, 1¾ × 9 in., finished oak.
Two side plates, 3 × 7 in., Norway pine.

A meeting of the Executive Committee of the Master Car-Builders' Association was held in New York on Oct. 13, 1887, and the letter-ballots relating to the adoption of various standards were canvassed.

On the adoption of the Janney type of automatic coupler as the standard of the Association there were 474 votes in favor and 194 against. It was, therefore, declared adopted.

None of the other standards submitted to letter-ballot received the requisite two-thirds vote, and, therefore, were defeated.

The resignation of the Secretary of the Association was considered and the Committee unanimously refused to accept it.

The Standard Coupler.

It is also announced, Oct. 19, that the following resolution was adopted at the last meeting of the Executive Committee:

Resolved, That a sub-committee of five be appointed to critically examine the different forms of couplers coming within the Master Car-Builders' type, and report the result of their examination to the Executive Committee on the second Thursday in January, 1888, for their further action. Messrs. Wall, Wade, Lentz, Cloud and Forney were appointed the Committee.

The Management of the Railway Paint Shop.

BY E. L. BIGELOW,

Master Car Painter Baltimore & Ohio Railroad.

Mr. President and members of the Convention:

Every master painter in order to manage his department successfully should have full control of his shop, men and material, as he knows best what condition his shop should be in as to light, ventilation, draughts of air, etc., and what other work aside from painting could be done there without interfering with or delaying the legitimate work of the paint shop, and no other should be allowed there without his permission. This, I am sorry to say, is not always asked for, but with the idea in view to expediate business, tinners, wood-workers, and iron-workers are ordered to go in and do work that should be done in the wood shop, roofs are covered, trucks overhauled, wheels changed and floors laid, making no end of dirt, and the shop that should be kept the cleanest is often the dirtiest. The painter, meanwhile, is fighting an up-hill battle, getting in a blow now and then as an opportunity shows itself, doing his utmost to make his work look presentable, as he well knows that on it depends the beauty and finish of the whole job. This is all wrong, and the paint shop should be what its name implies, the place where the work is painted, and managed by the master painter, who should have full control of his men, both in hiring and discharging; also in rating their wages, as he, being with them all the time, is best able to judge of their capabilities and value, and they recognizing him as their head under these conditions will never fail to show him proper respect in his position and respond promptly when he calls on them to exert themselves

The men should be classified as much as possible. There should be cleaners to do the washing and rubbing down, working in gangs, one to clean outside of car bodies, also to rub rough stuff, another to clean trucks, still another to clean the inside of the car bodies and rub varnish, both outside and inside. These gangs should be made up of laborers or cheap help, and can be trained to do the work acceptably and at considerable less cost than the skilled painter, who can be employed on work more congenial to his tastes and with more profit to his employ——.

There should be brush hands to do the coating and varnishing on the outside of bodies; also varnishers to do the interior work. The latter can be borrowed from the varnish room, as I contend the interior work is all in their line and should be kept separate from the outside.

There should also be a striping gang, composed of stripers and pencil hands, to do the striping and ornamental work. The designing and lettering are specialties, and no well conducted shop should be without an expert designer and letterer.

Good results can be obtained by working the cleaners in gangs of four, the brush hands in pairs and the stripers in gangs of four when striping a car body, working them together as much as possible in order to keep them in condition to turn out better work and more expeditiously than if engaged in all kinds of work. This will make them to a great extent experts in this particular line. When there is no coach ready for them the gang can be divided and worked in smaller jobs as stripers or as brush hands. Piece-work has been introduced in a great many shops, and like every thing else has its friends and its enemies. I must confess a friendly feeling for it, as it has proven to be what many shops needed and has infused new life into the men and shown them that they were capable of doing what seemed to them impossibilities. The great objection offered against this system by some master painters is that the men will slight their work. I have found that if the delinquent is required to make a bad job good in his own time, and at his own expense, this evil soon corrects itself. My experience has been that more work is got out and in less time than if done by the day, and the men are paid for the amount of work done, not for the time consumed in doing it.

Every well conducted paint shop should have a stock-room in charge of a keeper, and all material used in the shop or to fill orders should pass through his hands, and strict account kept by him of all material disbursed. This will be found a saving of a great deal of waste, and a great help to the master painter, as no person can have access to the paint stock except the keeper or himself without his knowledge, thereby doing away with a great many of the devilries that his material is supposed to be possessed of when all hands dip into any thing they see fit.

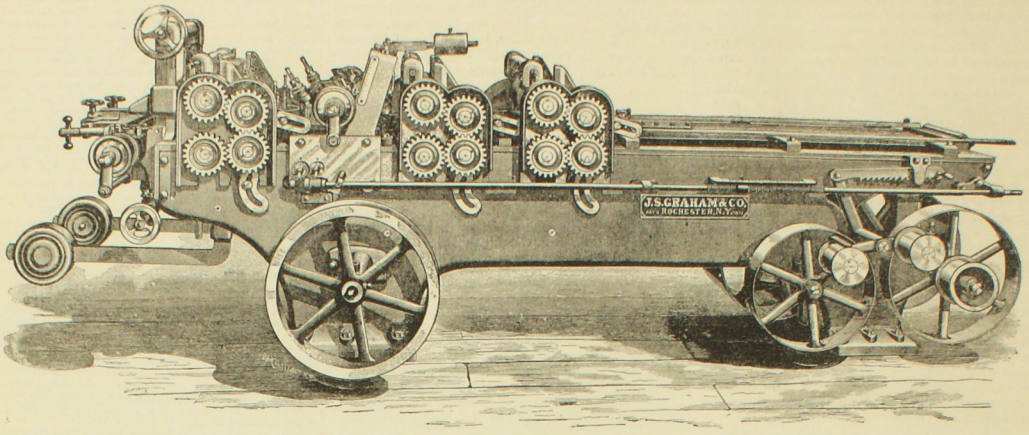
As to material. I may be trading on forbiden ground when I express my views, but as it seems to come under the head of the subject given me, and is "all for the good of the order," I feel constrained so give you my opinion.

The best judge of paint material is the painter, and if the chemist is called in to analyze the component parts of paint or varnish, his results do not differ materially from the practical tests of the painter who, in long experience from the incipient stages of his apprenticeship, when he gets an inkling of the trials and troubles that are in store for him as he is acquiring a knowledge of his business, up to the time when he is prepared to take the shop as master painter, eminently fits him to discriminate between good and bad material; in fact, he has an intuition, as it were, when he is working the material, whether it is adapted to the work or not, which is only gained by long experience and close observation, and as his reputation is to a great extent his capital, he is not going to hazard it or stultify himself by recommending material that is unfit or unprofitable.

St. Petersburg Exhibition.

A permanent technical exhibition and exchange has been opened in St. Petersburg, under the patronage of the Minister of the Interior and Public Works, and by the Association of Engineers of Ways of Communication, which seems to be worthy of being brought to the attention of the American people. It proposes to cover the entire field of civil, mechanical and sanitary engineering, railroad equipment and manufactures, each department to be in charge of specialists in that particular line. Its especial object purports to be the development of trade between Russia and foreign countries. The Russian Government has shown a tendency to construct its own great works, rather than to entrust them to private individuals or firms, and the Government is reported to be in need of quantities of various engineering supplies, such as will be exhibited in this display. The exhibition will also act as an agency to effect sales for exhibitors and others, and to facilitate the business of patent solicitors in securing Russian patents. Mr. A. Warschawsky, 14 Dey street, New York City, has been appointed general agent for America. Particulars may be obtained of him.

There is now on exhibition in the Grand Pacific Hotel, Chicago, Dyer's Railway Automatic Fire Extinguisher, a device which attracts considerable attention from the railway officers frequenting that famous caravansary. The device consists of a cylinder containing an extinguishing mixture and a pressure of air or gas. A valve operated by a pendant ball admits the fire extinguishing liquid into the stove in case of accident. A severe bump or the tipping over of the car will operate the valve with the result that the fire will be extinguished. Another attachment provides means of blowing out the lights at the same time,



STANDARD RAPID FEED FLOORING MACHINE

The engraving represents J. S. Graham & Co.'s New Pattern Standard Rapid Feed Flooring Machine, 12 ft. 8 in. long, built to work 8, 14 and 26 in. wide, 6 in. thick, weighing 6,500, 7,200 and 8,800 pounds respectively, and designed with special reference to high speed and fast feed, to meet the wants of mills doing a large amount of business and producing the finest kind of work. It has been constructed from an entirely new set of patterns, combining several novel features and improvements, and is remarkable for its great strength, durability, simplicity and convenience of operation. The top cutter head is forged steel slotted on two or four sides, as preferred, fitted with a tool steel shaft two inches in diameter running in boxes eleven inches long. These boxes are all connected together in one casting by a heavy yoke between the cutters and pressure bar. The box caps are let together by a planed tongue and groove and cannot twist or get out of line. The pressure bars are arranged to raise and fall with the cylinder and can be set to and from the cutters for ordinary surfacing or deep cutting, similar to novelty siding, etc. The pressure bar on the rough lumber is arranged to yield any distance by raising and swinging on the same same center as the cutter head, allowing a closer adjustment than any other form. The pressure bar on the finished lumber is made to yield a limited amount for wet or resinous lumber, etc. The under cutter carries four knives, is made of the same material as the top cutter, and has bearings 11 inches long, 2 inches in diameter. It is arranged to raise and lower for surfacing, beading, rabbeting, etc., and has perfect pr ss plates, throat plates and our improved end apron, making it the most perfect and convenient under cutter now built. It is the most convenient and easily accessible of any made, and will be duly appreciated by those who have had experience with under cutters on any other machines. The side cutters are of late design, and will be found to meet all the requirements of those who need a perfect matching machine. The spindles are of tool steel, one and three-fourth inches in diameter, fitted in long bearings and run on our patent self-oiling and self-adjusting step which has proved itself perfect in regard to wear. The left hand head travels across the machine by turning a crank either at the side or end of the machine. The right hand head and guides are also moved across the width of the machine by turning one crank. By this improvement lumber of any width is beaded with the tongue to the guide, and equal wear obtained for the bed, pressure bars and knives. Both heads are fitted with our patent shavings hood, and the left hand head has our patent chip breaker, which revolves or gives any reasonable distance backwards and always on a perfect circle on the same center as the matcher head. This chip breaker has proven itself to be the only perfect and practical one yet used for side cutting. There are six feed rolls driven by a heavy train of powerful gearing. They are also fitted with our improved expansive gearing and parallel movement, avoiding the possibility of tipping the rolls endways and straining and breaking the gearing. This improvement allows the rolls to yield or jump at least two inches and easily pass over stub shots, etc., as well as to give equal pressure on both edges of the board and cause it to always hug the guide and feed through straight. The method of weighting and raising the feed rolls is entirely new, and free from the usual top rigging and obstructions that are common to all other machines. The feed works are arranged to feed from 30 to 120 feet per minute. The 26 inch machine is made either with plain solid rolls in the usual way, or with our new improved divided rolls and pressure bars for the purpose of feeding two boards through at once, whether they be of the same thickness or not. This is a very important feature on a wide machine where it is required to perform double work with the same amount of help, and is particularly adapted to use in box factories, etc., or dressing siding which is afterwards resawn and jointed. Manufactured by J. S. Graham & Co., Rochester, N. Y.

Crosby Steam Gage and Valve Co.

The business of this company has had a steady growth since the company was formed in 1875. The building on Oliver street, which they have occupied since 1881, is completely outgrown and they have been obliged to seek more spacious quarters. With this end in view, they have purchased land within the city limits, and erected a large and substantial factory, especially adapted to their needs. The main building is 125 ft. long and 45 ft. wide; three stories high, above a light and airy basement; an ell 70 ft. long and 46 ft. wide contains foundry, blacksmith-shop and boiler room. The whole is built of brick, in the most thorough and substantial manner, and with special regard to the health and comfort of the employés. It is supplied with all the best known and approved appliances for the prevention and extinguishment of fire.

The rooms are of ample height and have abundant window space for the admission of light and air on all sides. This company are adding to their present large equipment a good many new machines and tools of special design and adapted to the particular requirements of their various products, many of which, like the steam engine indicator, the higher grades of pressure gages and other recording instruments, require the utmost nicety and precision in their construction. With such largely increased facilities for manufacturing their specialties, the company expect to be able to meet promptly all demands which the trade may make upon them for their well known products in the steam goods line. The new building was ready for occupancy about the middle of October. The salesrooms and offices of the company will remain at 95 Oliver street, Boston, as heretofore.

The Painter's Hand-Book. By B. S. Mills, Secretary of the Master House Painters' Association. Published by The Eckstein White Lead Co., Cincinnati, O. This little book is of a size suitable for the pocket, and contains a well arranged mass of information upon color harmony; the properties of colors; practical rules for the mensuration and preparation of work; the mixing and application of paint to get various kinds of finish; the oiling, varnishing and polishing of hard wood; together with formula for mixing 116 variations of colors or shades, each of these varieties being shown by illustrated specimen tints admirably executed. Each specimen is named, and the elements composing it designated by reference to the accompanying key. As a handy compendium of chromatic information the volume will be found highly serviceable to painters. Price $2.50 per copy.

The through train of the Burlington route, C., B. & Q. R. R., leaving Chicago in the evening for St. Paul and Minneapolis, makes connection with through trains from the East at Chicago, and at St. Paul and Minneapolis with through trains for Manitoba, Portland, Tacoma and all points in the Northwest. The night train is equipped with through Pullman sleeping cars and C., B. & Q. passenger coaches with dining car en route. To the day train service has recently been added Pullman parlor cars through to St. Paul and Minneapolis, in addition to the through C., B. & Q. passenger coaches and dining cars en route. Delightful scenery, smooth track and road-bed and as quick time as by any other line if you make your journey to St. Paul and Minneapolis via the Burlington.

Tickets can be obtained of any coupon ticket agent of the C., B. & Q. R. R. or connecting lines, or by addressing Paul Morton, Gen'l Pass. and Ticket Agent, Chicago.

THE HOLTON CABLE MANUFACTURING COMPANY, of Hornellsville, N. Y., are meeting with a lively demand for Preston's patent braided fence wire, which is reported to serve all purposes of barbed wire without having the objectionable features of the latter. Three strands of wire are braided together and form the medium of an elastic fence which stretches when very heavy tension is put upon it, and then returns to its former condition. This prevents the wire from breaking through the contraction of very cold weather, and the line is under sufficient tension to keep tight under the expansion of the hottest days of summer.

THE PHOSPHOR BRONZE SMELTING CO. (Limited), of Philadelphia, invite attention to the merits of their Phosphorized Anti-Friction Metal, a first-class article in every respect for heavy pressure and high speed. It is used in the same manner as Babbitt metal, and possesses the desirable qualities of fluidity when melted, freedom from dross and shrinkage, and low specific gravity, and will fill more bearings than inferior metals. It has been used for years by several large consumers with the highest satisfaction, and having demonstrated its excellence, the company desire to extend its use, and to that end solicit trial orders.

THE JOS. DIXON CRUCIBLE CO., Jersey City, N. J., call attention to their Silica-Graphite Smoke-Stack and Boiler Front Paint for locomotive and steamboat stacks, smoke arches, ash-pans, boiler fronts and other iron work. It is durable and beautiful, is not affected by rust or changes of temperature, and is a sure protection against the influence of a salt atmosphere. The company's circular contains an extensive list of manufacturers who are using the paint, also testimonials, price lists, directions for using, etc.

THE UNION INDURATED FIBER CO. have started a factory at Skowhegan, Me., for the exclusive manufacture of primary and secondary battery jars, which will be called "Fiberite" jars. Mr. A. S. Emmons, purchasing agent of the Newport News & Mississippi Valley Co., recommends the indurated fiber pails of the above named company for railroad purposes, after having given them a year's trial.

THE NUBIAN IRON ENAMEL CO., of Chicago, have removed their works from 207 South Canal street, of that city, to 252, 254 and 256 West Jackson street. The change of location has been rendered necessary by the company's rapidly increasing business. Its new quarters will enable it to more than double its capacity.

THE NATIONAL PAINT WORKS, of Williamsport, Pa., report a large increase in the demand for their Asphaltum Paint, so much so, that it has become necessary for one of the members of the company, Mr. W. H. Loomis, to locate in New York City, so as to be better able to look after the interests of his firm.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any error that may be noticed in our list:

Buffalo, Rochester & Pittsburgh.—Alonzo Dolbeer has been appointed Superintendent of Motive Power, vice C. W. Mills, resigned.

Chesapeake & Ohio.—J. T. Odell, late of the Northern Pacific, has been appointed Superintendent.

Colorado Midland.—B. C. Bosworth has been appointed Superintendent of Machinery, vice Wm. Fuller. The office of Purchasing Agent has been abolished, and T. R. Gable appointed Material Agent.

Indianapolis, Decatur & Springfield.—C. B. McVay has been appointed Purchasing Agent by H. B. Hammond the Receiver.

Mexican National.—Henry Yonge, of New York, has been appointed General Superintendent.

Mobile & Ohio.—R. H. Duesberry has been appointed Purchasing Agent, vice M. Sweeney resigned.

Northern Pacific.—J. T. Odell has resigned as Assistant General Manager, to accept the superintendency of the Chesapeake & Ohio.

Rome, Watertown & Ogdensburgh.—F. J. Britton has been appointed Superintendent of the Western division, vice W. H. Chauncey, resigned.

San Antonio & Aransas Pass.—E. P. Henderson has been appointed Master Mechanic, vice H. F. Nichols resigned.

Western, of Alabama.—C. D. Wall has resigned as Master Car-Builder of the Montgomery shops.

Wisconsin Central Line.—John Player, late of Central Iowa road, has been appointed Superintendent of Motive Power.

Employment.

WANTED.—By a Car-Building Company, a first-class Draughtsman, well acquainted with freight car construction and able to make estimates of quantities from drawings and specifications. Address P. O. Box 178, Detroit, Mich.